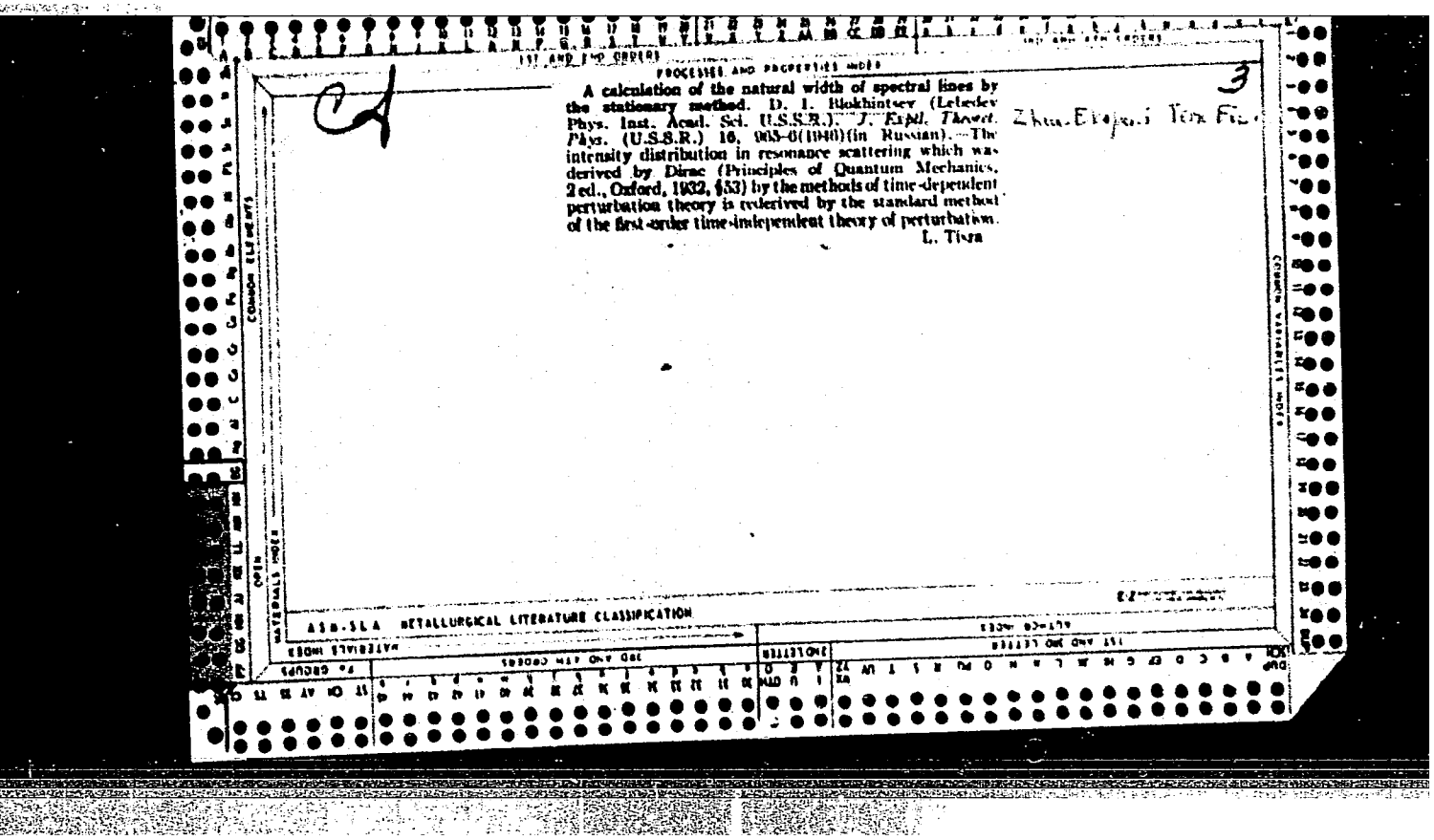


PROCESSES AND PROPERTIES INDEX

A calculation of the natural width of spectral lines by the stationary method. D. I. Blokhintsev (Lebedev Phys. Inst. Acad. Sci. (U.S.S.R.)). *J. Exptl. Theoret. Phys.* (U.S.S.R.) 10, 905-6(1940)(in Russian).—The intensity distribution in resonance scattering which was derived by Dirac (Principles of Quantum Mechanics, 2 ed., Oxford, 1932, §53) by the methods of time-dependent perturbation theory is rederived by the standard method of the first-order time-independent theory of perturbation.
L. Tisza

Zhur. Eksper. Teor. Fiz.

3

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

BLOKHINZEV, D.

PA 26T66

USSR/Physics Jan 1947
Mass Spectrometers
Wave Analysis

"Wave Field with the Spectrum of Masses," D. Blokhinzev, Institute of Physics imeni P. N. Lebedev, Academy of Sciences of the USSR, 5 pp

"Journal of Physics" Vol XI, No 1 Zhur. Fiz.
ALSO IN DOK AN 72, No 1, VOL II, 1947

The general wave equations of a single particle are set up to study the possibility of its possessing several masses with mutual interference, as opposed to the case of constant mass with different energies.

BS 26T66

Blokhintsev, D. A non-Hamiltonian method in the theory of elementary particles. Acad. Sci. USSR. J. Phys. 11, 179–183 (1947).

This summarises an attempt to [illegible] between the Heisenberg phase-matrix scheme and Hamiltonian methods. The latter demand an invariant time-ordering of cause and effect, produce divergent results [illegible] theory of extended particles they attribute [illegible] of heavy particles to the effects of a light particle. Here, an "elementary scattering matrix" r is introduced to describe the absorption or emission of a light particle. The scattering matrix R determining the scattered waves ψ_s from the primary waves ψ_i by $\psi_s = R\psi_i$ is replaced by two matrices so that $\psi_s = R_{sr}\psi_i + R_{ss}\psi_s$, R_{sr} determining the relation between primary and scattered waves neglecting reaction of the scattered waves, and R_{ss} accounting for this reaction; R_{sr}, R_{ss} are given in terms of r. Suggestions are made about a relativistically invariant cut-off factor to introduce a "universal length" parameter s_0 to remove divergences. This leads to a relation between s_0 and the mass of the heavy particle. *C. Strachan* (Aberdeen).

Source: Mathematical Reviews, 1948, Vol 9, No. [illegible]

BLOKHINTSYEV, D. I. PA 57T69

USSR/Nuclear Phys - Mass Spectrographs Feb 1947
Math, Applied

"Wave Field With Mass Spectrum," D. I. Blokhintsyev, Phys Inst imeni P. N. Lebedev, Acad Sci USSR, 6 pp

"Zhur Eksper i Teor Fiz" Vol XVII, No 2 pp 111-120

Examines linear equations with higher derivatives of unlimited high order. Establishes limits for operators of these equations. Gives case of scalar field particularly close examination. Article also appears in English in "Journal of Physics" Vol XI, p 72, 1947.

[redacted] 57T69

CA

3

A non-Hamiltonian method in the theory of elementary particles. D. I. Blokhintsev (Lebedev Inst. Physics Acad. Sci. U.S.S.R.). *Zhur. Eksptl. i Teoret. Fiz.* 17, 200-71(1947).—Hamiltonian methods, based on the predictability of phys. reality at the moment $t + dt$ from its state at the moment t, are inconsistent with the concept of extended particles. A non-Hamiltonian treatment, involving only the detn. of a wave function ψ_∞ at $t = \infty$ from ψ_0, but closer to the Hamiltonian method than Heisenberg's (*C.A.* 37, 6187°) phase matrix scheme, which lacks correlation with the relativistic concept of particle interaction, is developed with the aid of an "elementary scattering matrix" r describing the act of absorption or emission of a light particle. The elements of the matrix satisfy the condition of relativistic invariance. The scattering matrix is then expressed as a function of r. A wave function representing a compromise between the phase matrix and the Hamiltonian method is obtained with the aid of two scattering matrixes, only the 2nd of which involves the reaction of the scattered waves. Its special cases are the scattering equation of Ma and Hsüeh (*C.A.* 39, 15°) and the relativistic equation of Tamm (*J. Phys.* (U.S.S.R.) 9, 449(1945)) for the interaction of particles. Introduction of invariant factors lifts the Hamiltonian inconsistency with the extension of particles, i.e. with a definite small scale of length. The mass of a particle becomes detd. by that universal parameter, through the condition that the mass due to interaction between the particle and the field becomes zero, in some analogy with the classic Lorentz principle of the total force exerted on a free electron by its own field. N. T.

BLOKHINTSEV, D. I.

USSR/Physics Sep 1947
Microscopes, Electron
Atoms

"The Atom in the Field of Vision of an Electron Microscope," D. I. Blokhintsev, 4 pp - Physics Inst. im. P.N. Lebedev, AN SSSR.

"Zhur Eksper i Teoret Fiz" Vol XVII, No 9 pp. 814-17

The article discusses the conditions which arise during the observation of an atom through an electron microscope. It is shown that it is possible to obtain several thousand dispersions of electrons before the atom is knocked out of its location. Great importance is attached to the formula $\tau = \frac{e}{\Omega j}$, where e is the electronic

[redacted] 26T79

USSR/Physics (Contd) Sep 1947

charge, Ω the measure of the atom, j the current and τ the period of time between the individual atoms of dispersion. Submitted at the Institute of Physics imeni P. N. Lebedev, Academy of Sciences of the USSR.

[redacted] 26T79

Blohincev, D. I. The principle of detailed balancing and quantum mechanics. Akad. Nauk SSSR. Zhurnal [illegible] Teoret. Fiz. 17, 924–929 (1947). (Russian)

The principle of reversibility is a consequence of [illegible] classical or quantum mechanics. It can be stated as $P_{\alpha\beta}(t) = P_{\beta\alpha}(-t)$, expressing the equality [illegible] of inverse transitions if the sign of the time is reversed. If k, l designate momenta and if the Hamiltonian is invariant with respect to a change of sign of k, l and the magnetic field H, one has the alternate form $P_{-k,-l}(t,-H) = P_{k,l}(t,H)$. In contrast, the principle of detailed balancing would be $P_{\alpha\beta}(t) = P_{\beta\alpha}(t)$. The method of perturbation with radiation damping is used to show that the principle [illegible] balancing is not generally valid if the [illegible] not central. This is demonstrated for the scattering of a charged particle by a fixed dipole.

L. Tisza (Cambridge, Mass.)

Source: Mathematical Reviews. Vol 7 No. 2

I. Fizicheskiy Inst. Im. P. N. Lebedev [illegible]
(Quantum Theory)

BLOKHINTSEV, D.I. PA 50T95

USSR/Physics - Development Mar 1947

"Development of Theoretical Physics in the Soviet Union," D. I. Blokhintsev, 8½ pp

"Uspekhi Fiz. Nauk" Vol XXXIII, No 3

Intends to show that Soviet scientists in field of theoretical physics advanced to state where they are able to proceed unaided along path of success. Soviet theoretical physics has attained position of leadership among all nations. Briefly mentions some of more outstanding Soviet theoretical physicists and their work.

LC 50T95

Blokhincev, D. I. Field theory of extended particles. Vestnik Moskov. Univ. 1948 no. 1 83-91 (1948) (Russian)

The author has developed independently a relativistic and divergence-free classical field theory, which is substantially identical with the theory of Peierls and McManus [...] The theory [...] is derived from the [...] Lagrangian by replacing the interaction [...] where [...] an unspecified integration [...] by the integration [...] from point-particles to particles whose charge-density has a finite extension in space and time. [...] the equations of motion [...] action principle, are integrodifferential equations, consequently in addition to physically admissible solutions they possess "nonphysical" solutions which [...] by suitable boundary conditions [...]

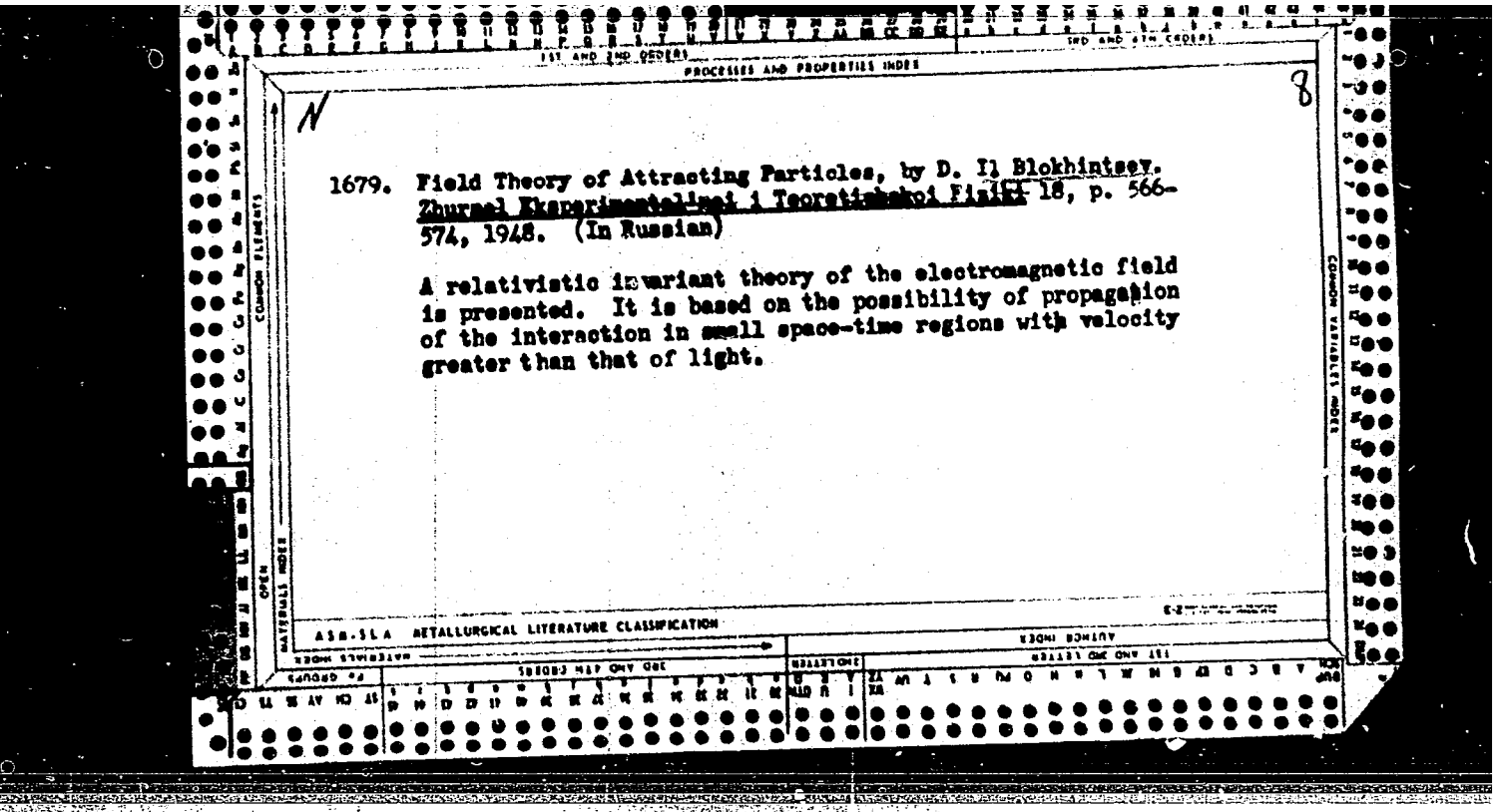
[...] Rev. Modern Phys. [...]

Vol. [...] No. [...]

Source: Mathematical Reviews,

BLOKHINTSEV, D. I.

Blokhintsev, D. I. and Briskina, Ch. M. "The connection between the mathematical apparatus of quantum mechanics and that of classical mechanics", Vestnik Mosk. un-ta, 1948, No. 10, p. 115-18.



1679. Field Theory of Attracting Particles, by D. I. Blokhintsev. Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki, 18, p. 566-574, 1948. (In Russian)

A relativistic invariant theory of the electromagnetic field is presented. It is based on the possibility of propagation of the interaction in small space-time regions with velocity greater than that of light.

BLOKHINTSEV, D. I.

PA 37/49T110

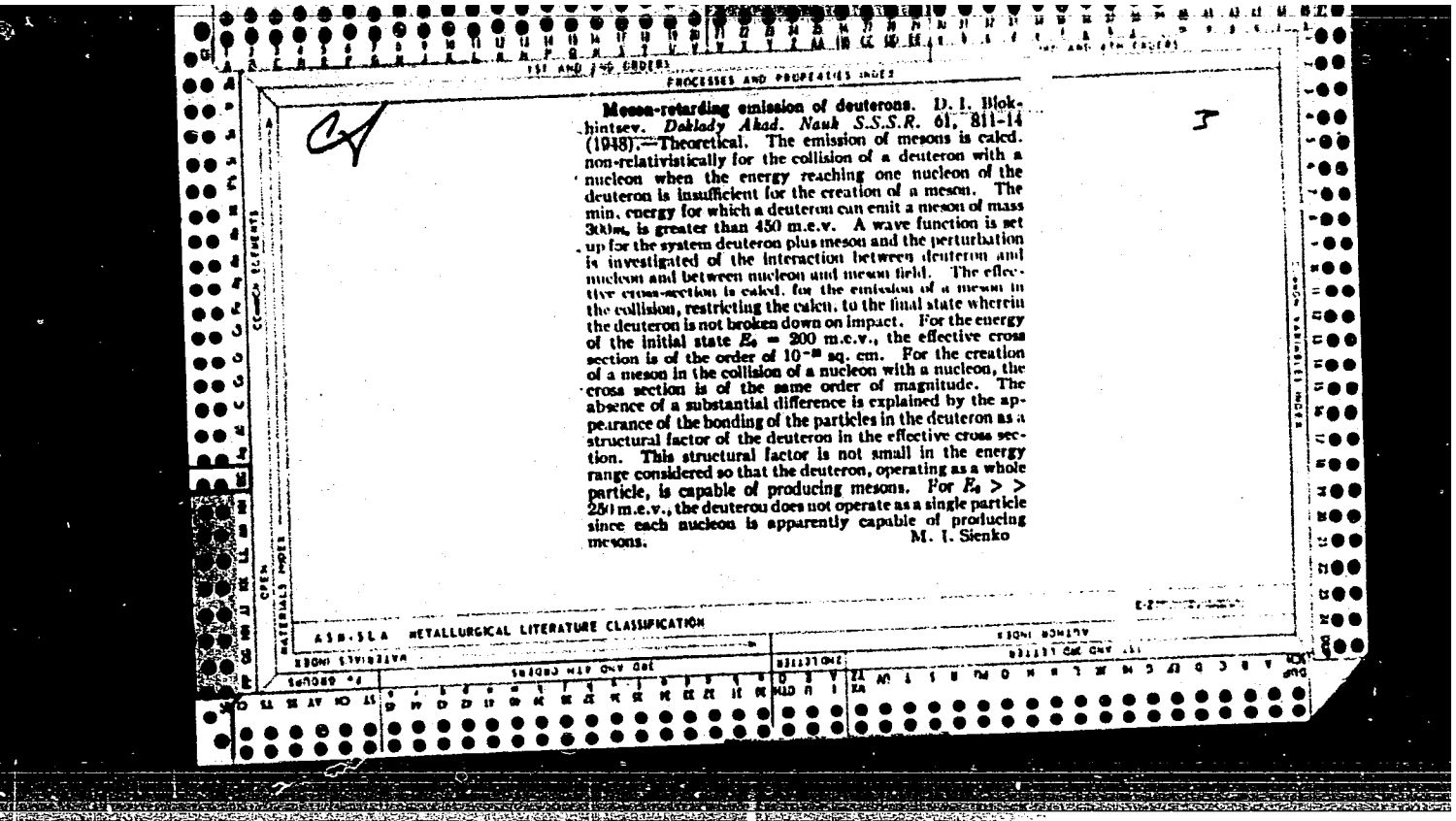
USSR/Physics Nov 48
Diffraction
Mathematics - Applied

"The Microparticle and Its Diffractional Representation," D. I. Blokhintsev, 5 pp

"Uspekhi Fiz Nauk" Vol XXXVI, No 3

Determines experimentally the solution for the question, "What can be said of the structure of matter, knowing the effective diameter or by the distribution of the I factor on a screen?" After complicated mathematical treatise, author concludes it is impossible to establish the nature of the structure of matter by mere diffraction observations.

37/49T110



PROCESSES AND PROPERTIES INDEX

Meson-retarding emission of deuterons. D. I. Blokhintsev. *Doklady Akad. Nauk S.S.S.R.* 61, 811-14 (1948).—Theoretical. The emission of mesons is calcd. non-relativistically for the collision of a deuteron with a nucleon when the energy reaching one nucleon of the deuteron is insufficient for the creation of a meson. The min. energy for which a deuteron can emit a meson of mass 300m_e is greater than 450 m.e.v. A wave function is set up for the system deuteron plus meson and the perturbation is investigated of the interaction between deuteron and nucleon and between nucleon and meson field. The effective cross-section is calcd. for the emission of a meson in the collision, restricting the calcn. to the final state wherein the deuteron is not broken down on impact. For the energy of the initial state E_0 = 200 m.e.v., the effective cross section is of the order of 10^{-28} sq. cm. For the creation of a meson in the collision of a nucleon with a nucleon, the cross section is of the same order of magnitude. The absence of a substantial difference is explained by the appearance of the bonding of the particles in the deuteron as a structural factor of the deuteron in the effective cross section. This structural factor is not small in the energy range considered so that the deuteron, operating as a whole particle, is capable of producing mesons. For $E_0 >> 250$ m.e.v., the deuteron does not operate as a single particle since each nucleon is apparently capable of producing mesons.

M. I. Sienko

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

BLOKHINTSEV, D. I.

"Current Literature: Laws Governing Alpha-Decay," (Source: I. Perlman, A. Ghiorso, and G. T. Seaborg in Phy. Rev 74 and 75). Uspekhi Fiz. Nauk 39, No. 1, 1949.

pp. 134-36

BLOKHINTSEV, D. I.

"Current Literature: The Energy Distribution of the Fragments in the Fission of Uranium U-235 and U-233," (No Russian Sources) Uspekhi Fiz. Nauk 39, No. 1, 1949.

Mbr. Ed. Bd., Iz. Ak. Nauk SSSR Ser. Fiz.

W-138-40

BLOKHINTSEV, D. I.

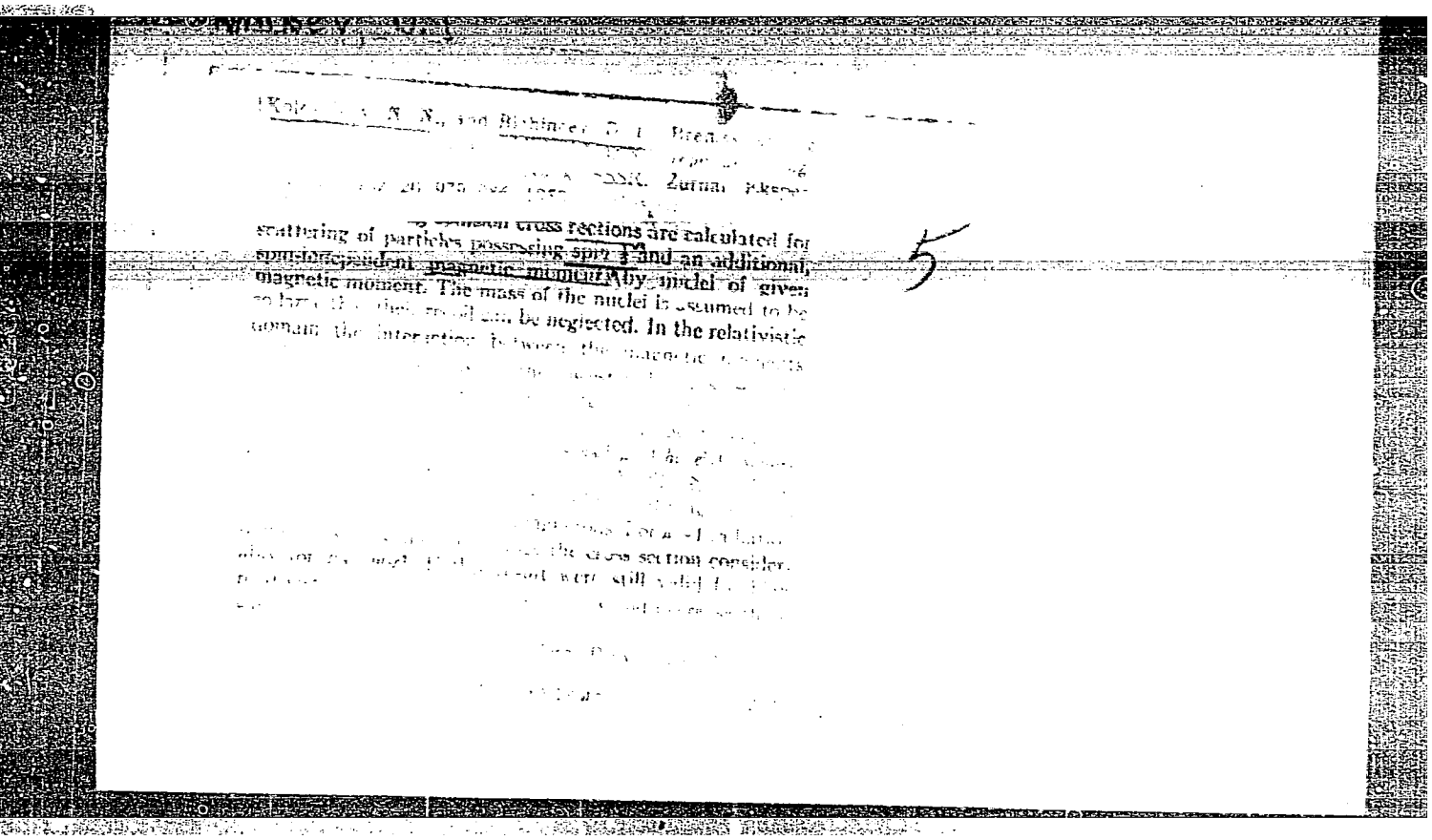
D-67 BLOKHINTSEV, D. I. Osnovy kvantovoy mekhaniki (Principles of quantum mechanics), 2nd ed. Moscow, Ges. izd-vo tekhn.-teoret. lit-ry 1949. 588p. [illegible]

A course of lectures on quantum mechanics taught by the author during his years in the department of Physics at Moscow University. For this book, which is approved by the Ministry of Higher Education as a manual for the State Universities, the author received a Stalin prize.

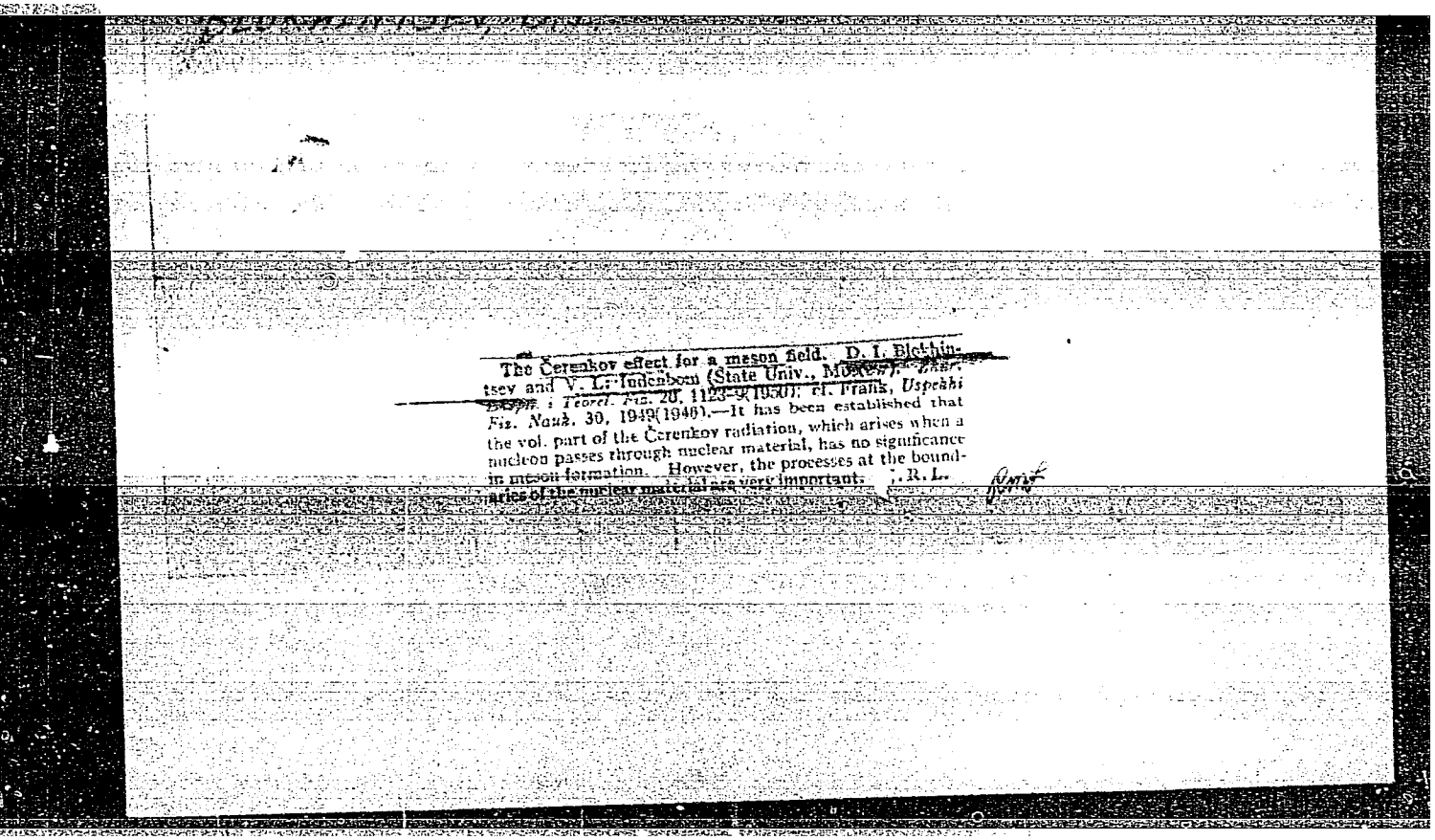
(Moscow-Leningrad, State Technical Press, 1949). Reviewed by S. V. Vonsovskiy, Sov. Kniga, No. 11, 1950.

Blohincev, D. I. The theory of moving sources and sound receivers. Učenye Zapiski Moskov. Gos. Univ. Fizika. 134, kniga 5, 134-144 (1949). (Russian)

[illegible] Vol. 13 No. 2



scattering of particles possessing spin $\frac{1}{2}$ and an additional, magnetic moment. The mass of the nuclei is assumed to be



The Čerenkov effect for a meson field. D. I. Blokhintsev and V. L. Ginzburg (State Univ., Moscow). *Doklady Akad. Nauk SSSR* [N.S.] 70, 1123–8 (1950); cf. Frank, *Uspekhi Fiz. Nauk*, 30, 149(1946).—It has been established that the vol. part of the Čerenkov radiation, which arises when a nucleon passes through nuclear material, has no significance in meson formation. However, the processes at the boundaries of the nuclear material are very important. J. R. L.

Blohincev, D. I. **Elementary particles and fields.** Uspehi Fiz. Nauk 42, 76–92 (1950). (Russian)

A general expository article on the background of current theories of the relation of particle and field aspects of atomic physics. It is in three sections entitled: (1) What does quantum mechanics say about the nature of particles? (2) Particles arising from quantization of an harmonic oscillator field. (3) Particles and the principle of spectral decomposition. *A. J. Coleman* (Toronto, Ont.).

Source: Mathematical Reviews, Vol. 12 No. 8

BLOKHINTSEV, D. I.

183T92

USSR/Physics - Unified Field Theory May 51

"Does the Dualism of Waves and Particles Always Exist?" D. I. Blokhintsev

"Uspekhi Fiz Nauk" Vol XLIV, No 1, pp 104-109

One of series of articles on unified fld theory of matter written in response to editor's request. Author proposes waves and particles may not be only possible states of matter. Studies consequences of the theory of interacting flds which indicate existence of states of flds not compatible with corpuscularity, i.e., that lead to rupture of dualism of waves and particles. In this sense the

183T92

USSR/Physics - Unified Field Theory (Contd) May 51

particles (photon, positron, electron, meson, nucleon, etc.) are merely excited states of corr flds. Illustrates rupture of dualism by example of 2 scalar waves, then examines herein.

183T92

PA 194T90

USSR/Physics - Quantum Theory Sep 51

"Criticism of Idealistic Concept of Quantum Theory," D. I. Blokhintsev

"Uspekh Fiz Nauk" Vol XLV, No 2, pp 195-228

This article was prepared by the author for the series "Philosophical Problems of Modern Physics," edited by the Inst of Phil, Acad Sci USSR. Author criticizes Heisenberg for his theories based on observations of frequencies and intensities of radiations, viscious concepts of idealism. Pauli's principle is illogical. P. Jordan quotes

194T90

USSR/Physics - Quantum Theory (Contd) Sep 51

materialism by Democritus and Laplace, entirely forgetting the logical principles of Marx, Engels, Lenin, Stalin, etc.

194T90

BLOKHINTSEV D. I.

BLOKHINTSEV, D. I.

"Elementary Particle and Fields," apaper delivered at the General Meetings of the Ukrainian SSR AS and its Depts. of Physical-Mathematical and Chemical Sciences. Referred to anf summarized by P. Borziak, Usp. Fiz. Nauk, Vol. 45, pp 622-629, 1951

BLOKHINTSEV, D. I.

USSR/Physcis - Mesons Electron Microscope Feb 52

"Letters to the Editor"

"Zhur Eksper i Teoret Fiz" vol XXII, No 2, pp 249-256.

(1) "theory of Close Order in Liquids," A. Ye. Glauberman, L'vov State U; (2) "Determining the Spin of Charged Pi-Mesons," I. M. Shmushkevich, Leningrad Phys-Tech Inst, Acad Sci USSR; (3) "Theory of Electrical Conduction of Binary Progressive Ordering Metallic Alloys," K. B. Vlasov, Inst of Phys of Metals, Ural Affiliate, Acad Sci USSR; (4) "Generalized Law of Interaction," D. I. Blokhintsev, Moscow State U; (5) Beta Spectrometer With Two Magnetic Lenses and With Internal Correcting Coils," V. S. Shpinel.

PA 207T85

Blokhincev, D. On the propagation of signals in nonlinear field theory. Doklady Akad. Nauk SSSR (N.S.) 82, 553–556 (1952). (Russian)

The author considers the classical theory of a scalar field ψ based on a generalized Lagrangian

$$L = L(K, I), \quad K = \tfrac{1}{2}[(\partial\psi/\partial t)^2 - (\nabla\psi)^2], \quad I = \tfrac{1}{2}\psi^2.$$

In a linear theory L will be a linear function of K and the field-equation will be a hyperbolic equation with characteristic surfaces everywhere coinciding with light-cones. In this case all signals will be transmitted with velocities not exceeding the light-velocity. But suppose L is not a linear function of K. Let $\xi = (dx/dt)$ be the direction of a characteristic surface describing propagation in the x-direction, i.e. independent of the other two coordinates y and z. Suppose $\alpha = (\partial^2 L/\partial K^2)/(\partial L/\partial K)$ is chosen to be small compared to unity. Then

$$\xi = \pm[1 - \tfrac{1}{2}\alpha((\partial\psi/\partial t) + (\partial\psi/\partial x))^2]$$

gives the two possible values of ξ. When α is negative we have in general $|\xi| > 1$, meaning that signals will be propagated with greater-than-light velocity.

An analysis of non-linear electrodynamics, a similar generalization of the Maxwell theory, shows that greater-than-light velocities will occur in exactly the same way there too. The author concludes by saying that it is hopeless to attempt to construct non-linear versions of quantum electrodynamics until these simple classical effects of the non-linearities are properly understood. *F. J. Dyson.*

Source: Mathematical Reviews, Vol 13 No. 8

1062. On the propagation of signals in nonlinear electrodynamics. D. I. BLOKHINTSEV and V. V. ORLOV, Zh. eksper. teor. Fiz., Vol 25, No. 5 (11) 513-526 (1953) In Russian.

An analysis of certain general properties of the mathematical apparatus of nonlinear electrodynamics, connected with the propagation of signals. The starting point is the electromagnetic field equations (based on a general Lagrangean L not assumed to be linear in E^2 and H^2) in which derivatives of L up to the second with respect to E2 and H2 appear explicitly. The resulting propagation of a signal depends on the values of the fields and leads in general to the existence of four signal velocities which can be both smaller and greater than c, and to the appearance of shock-waves. This is illustrated in a one-dimensional and a spherically symmetric example, the latter exhibiting the non-Euclidean nature of the metric in the vicinity of a point charge (curvature of a light signal). The Lagrangean of Born and Infeld (Proc. Roy. Soc., 144, 425 (1934)) appears as a special case of nonlinear electrodynamics in which light velocity is not exceeded.

W. J. SWIATECKI

BLOKHINTSEV, D. I. and NIKOLAYEV, N. A.

"The First Atomic Power Station of the USSR and the Prospects of Atomic Power Development," a paper presented at the Atoms for Peace Conference, Geneva, Switzerland, 1955

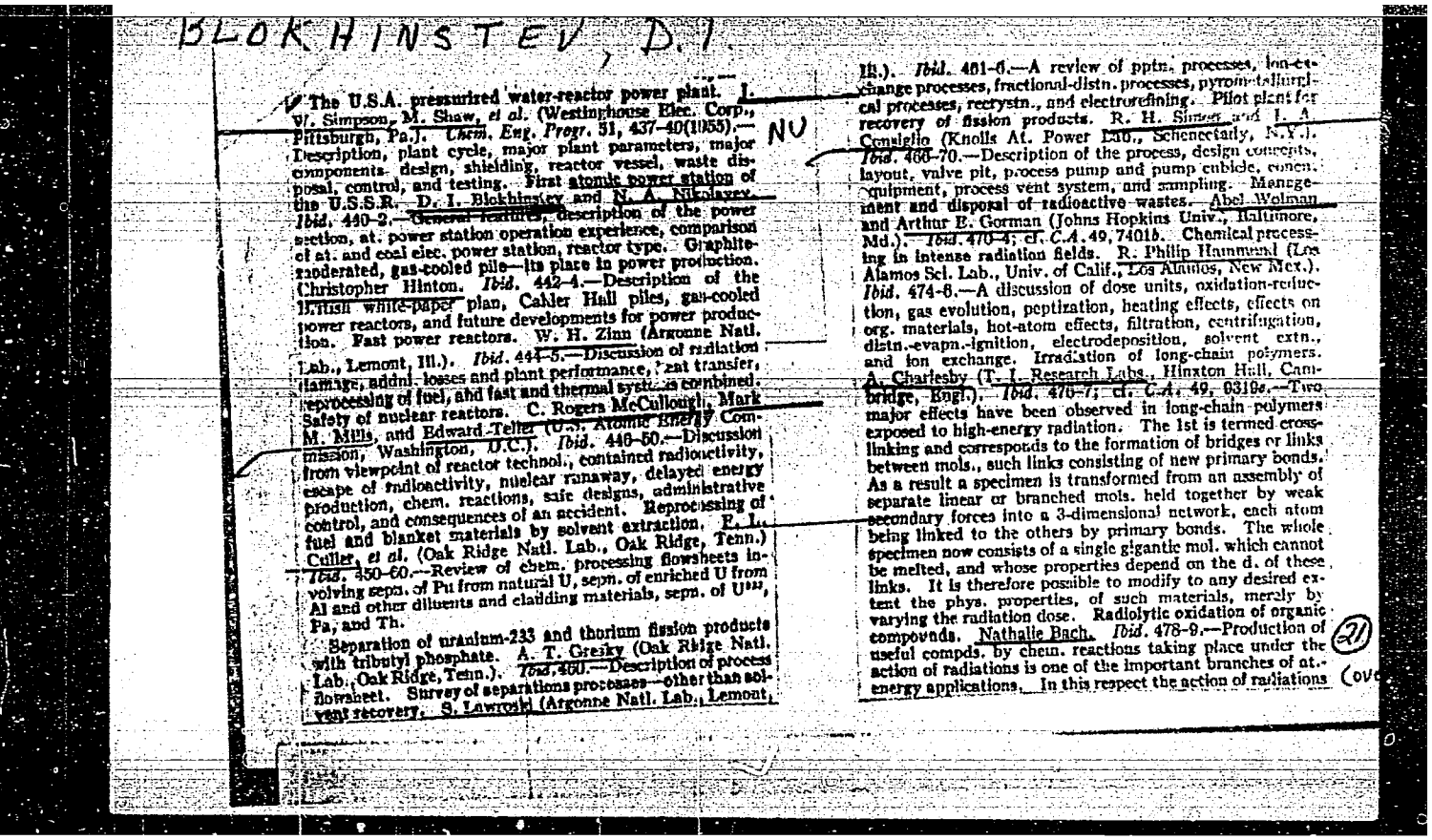
BLOKHINTSEV, D.I.

6496. Theory of nucleons. D. I. BLOKHINTSEV. *Zh. eksper. teor. Fiz.*, 29, *No.* 1(7) 33-6 (1935) In Russian. 530.145

The π-mesons in this theory interact only indirectly with nucleons, through an intermediary K-meson field. This gives rise to a form-factor in the interaction between π-meson and nucleon, providing a non-local interaction.

O. E. BROWN

Moscow State U.



BLOKHINSTEV, D.I.

The U.S.A. pressurized water-reactor power plant. J. W. Simpson, M. Shaw, *et al.* (Westinghouse Elec. Corp., Pittsburgh, Pa.). *Chem. Eng. Progr.* 51, 437–40(1955).—Description, plant cycle, major plant parameters, major components, design, shielding, reactor vessel, waste disposal, control, and testing. First atomic power station of the U.S.S.R. D. I. Blokhintsev and N. A. Nikolayev. *Ibid.* 440–2.—General features, description of the power section, at. power station operation experience, comparison of at. and coal elec. power station, reactor type. Graphite-moderated, gas-cooled pile—its place in power production. Christopher Hinton. *Ibid.* 442–4.—Description of the British white-paper plan, Calder Hall piles, gas-cooled power reactors, and future developments for power production. Fast power reactors. W. H. Zinn (Argonne Natl. Lab., Lemont, Ill.). *Ibid.* 444–5.—Discussion of radiation damage, addnl. losses and plant performance, heat transfer, reprocessing of fuel, and fast and thermal systems combined. Safety of nuclear reactors. C. Rogers McCullough, Mark M. Mills, and Edward Teller (U.S. Atomic Energy Commission, Washington, D.C.). *Ibid.* 446–50.—Discussion from viewpoint of reactor technol., contained radioactivity, escape of radioactivity, nuclear runaway, delayed energy production, chem. reactions, safe designs, administrative control, and consequences of an accident. Reprocessing of fuel and blanket materials by solvent extraction. F. L. Culler, *et al.* (Oak Ridge Natl. Lab., Oak Ridge, Tenn.) *Ibid.* 450–60.—Review of chem. processing flowsheets involving sepn. of Pu from natural U, sepn. of enriched U from Al and other diluents and cladding materials, sepn. of U^{233}, Pa, and Th.

Separation of uranium-233 and thorium fission products with tributyl phosphate. A. T. Gresky (Oak Ridge Natl. Lab., Oak Ridge, Tenn.). *Ibid.* 460.—Description of process flowsheet. Survey of separations processes—other than solvent recovery. S. Lawroski (Argonne Natl. Lab., Lemont, Ill.). *Ibid.* 461–6.—A review of pptn. processes, ion-exchange processes, fractional-distn. processes, pyrometallurgical processes, recrystn., and electrorefining. Pilot plant for recovery of fission products. R. H. Singer and J. A. Consiglio (Knolls At. Power Lab., Schenectady, N.Y.). *Ibid.* 466–70.—Description of the process, design comments, layout, valve pit, process pump and pump cubicle, concn. equipment, process vent system, and sampling. Management and disposal of radioactive wastes. Abel Wolman and Arthur E. Gorman (Johns Hopkins Univ., Baltimore, Md.). *Ibid.* 470–4; cf. *C.A.* 49, 7401b. Chemical processing in intense radiation fields. R. Philip Hammond (Los Alamos Sci. Lab., Univ. of Calif., Los Alamos, New Mex.). *Ibid.* 474–6.—A discussion of dose units, oxidation-reduction, gas evolution, peptization, heating effects, effects on org. materials, hot-atom effects, filtration, centrifugation, distn.-evapn.-ignition, electrodeposition, solvent extn., and ion exchange. Irradiation of long-chain polymers. A. Charlesby (T. I. Research Labs., Hinxton Hall, Cambridge, Engl.). *Ibid.* 476–7; cf. *C.A.* 49, 9319e.—Two major effects have been observed in long-chain polymers exposed to high-energy radiation. The 1st is termed cross-linking and corresponds to the formation of bridges or links between mols., such links consisting of new primary bonds. As a result a specimen is transformed from an assembly of separate linear or branched mols. held together by weak secondary forces into a 3-dimensional network, each atom being linked to the others by primary bonds. The whole specimen now consists of a single gigantic mol. which cannot be melted, and whose properties depend on the d. of these links. It is therefore possible to modify to any desired extent the phys. properties, of such materials, merely by varying the radiation dose. Radiolytic oxidation of organic compounds. Nathalie Bach. *Ibid.* 478–9.—Production of useful compds. by chem. reactions taking place under the action of radiations is one of the important branches of at.-energy applications. In this respect the action of radiations

BLOKHINTSEV D., and NIKOLAYEV, N.

"Perspectives of Atomic Power" an article in the publication Problems of the Use of Atomic Energy.
October, 1956, Moscow

BLOKHINTSEV. D.I.

"On the Generation of Mesons in Collisions of High Energy Nucleons," paper presented at CERN Symposium, 1956, appearing in Nuclear Instruments, No. 1, pp. 21-30, 1957

BLOKHINTSEV, D.I. and NIKOLAYEV, N.

Prospects of Atomic Energetics," a chapter from the book Problems in the Utilization of Atomic Energy, the second revised edition of a collection of articles, published in 1956, Moscow, USSR

BLOKHINTSEV, D., VEKSLER, V., and PONTEKORVO, B.

"Important Problems of Contemporary Physics" an article in the publication Problems of the Use of Atomic Energy, Moscow, Oct 56.

October, 1956, Moscow

BLOKHINTSEV, D.I.

FRENKEL', Ya.I.; SEMENOV, N.N., akademik, redaktor; SOKOVOV, A.A., doktor fiziko-matematicheskikh nauk, redaktor; BOGOLYUBOV, N.N., akademik, redaktor; TAMM, I.Ye., akademik, otvetstvennyy redaktor; ANSEL'M, A.I., doktor fiziko-matematicheskikh nauk, redaktor; BLOKHINTSEV, D.I., doktor fiziko-matematicheskikh nauk, redaktor; KONTOROVA, T.A., kandidat fiziko-matematicheskikh nauk, redaktor; GOLANT, V.Ye., redaktor izdatel'stva; SMIRNOVA, A.V., tekhnicheskiy redaktor

[Selected works] Sobranie izbrannykh trudov. Moskva, Izd-vo Akademii nauk SSSR. Vol.1. [Electrodynamics; general theory of electricity] Elektrodinamika; obshchaia teoriia elektrichestva. 1956. 370 p. (MLRA 9:11)

1. Chlen korrespondent AN SSSR (for Frenkel')
(Electrodynamics)

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1602
AUTHOR BLOKHINTSEV,D.I., DOLLEZHAL,N.A., KRASIN,A.K.
TITLE The Reactor at the Atomic Powerstation of the USSR Academy of Science.
PERIODICAL Atomnaja Energija, 1, fasc.1, 10-23 (1956)
Issued: 3 / 1956

For purposes of study and with a view of building larger reactors at a later date a reactor with 30 MW thermal- and 5 MW electric power was built; graphite was used as moderator and distilled water as coolant, because graphite captures few neutrons, is stable both mechanically as well as with respect to gas atmospheres, and because H_2O is safe from a biological point of view, is easy to control technically, and causes no disturbance of neutron equilibrium. Three constructions of cooling channels are discussed; tubes with 9 mm ∅ and 0,4 mm wall thickness are given preference in order that the pressure of 100 atm excess pressure, which is necessary because of the high temperatures, be absorbed.
30 MW in the case of a thermal load of 2.10^6 kcal/m^2.h correspond to 120 operation channels. The first test lasted 100 days with a charge of 550 kg of uranium enriched to 5% U^{235}.
Construction of the reactor: Cylindrical graphite block with 3 m ∅, in which there are 157 holes with 65 mm ∅ arranged in form of an aquilateral triangle, with 120 mm spacing. In the center is the reactor core surrounded by a graphite

Atomnaja Energija, 1, fasc. 1, 10-23 (1956) CARD 2 / 2 PA - 1602

reflector.
In the channels the water discends in a central tube and rises in four others. It is controlled by means of locking- and regulating-valves.
Reactor control: 24 boron carbide rods serve as control rods for the reception of excess activity, controlled by 12 ionization chambers with boron coating.
The graphite temperature is controlled by thermoelements.
Further measurements: Gas pressure and gas quantity in the reactor block, water pressure and water temperature when leaving the channels, as well as the usual measuring of the secondary circuit (for the generation of energy).

The reactor makes it possible to produce radioactive samples in channels with a flux of 8.10^{13} neutrons/cm^2 sec as well as to produce neutrons and γ -rays.

Since 1954, when the reactor began operating, biological protection has been found to be sufficient and the uranium rods could be utilized up to a very high degree. It is possible to use graphite reactors with slightly enriched uranium and water cooling in large industrial power plants.

INSTITUTION:

BLOKHINTSEV, D.I.

Category : USSR/Nuclear Physics - Nuclear Engineering and Power C-8

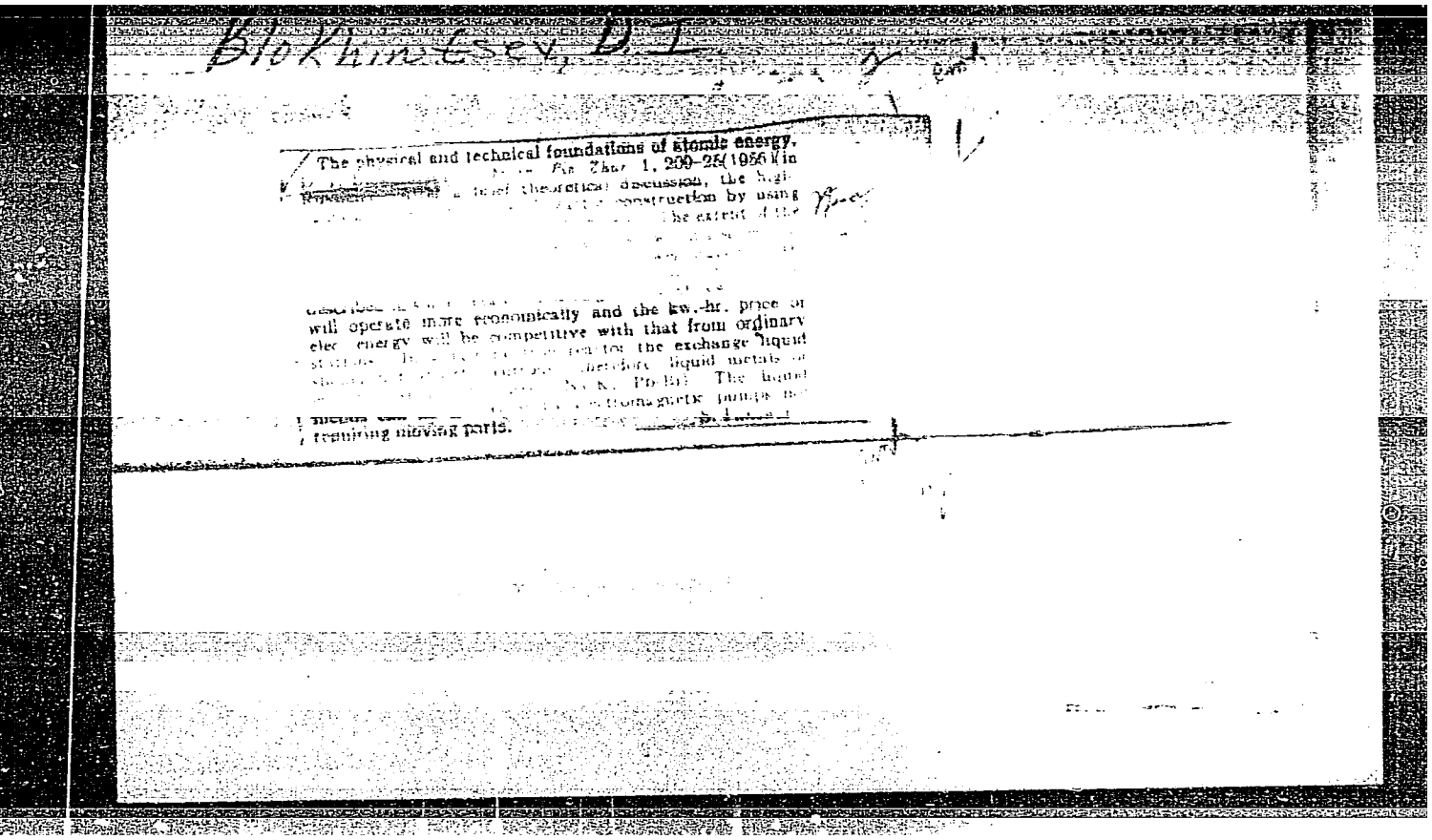
Abs Jour : Ref Zhur - Fizika, No 3, 1957, No 6105

Author : [redacted], Minashin, M.Ye., Sergeyev, Yu.A.
Title : Physical and Thermal Calculations for the Reactor of the Atomic Electric Station of the Academy of Sciences of the USSR

Orig Pub : Atom. energiya, 1956, No 1, 24-42

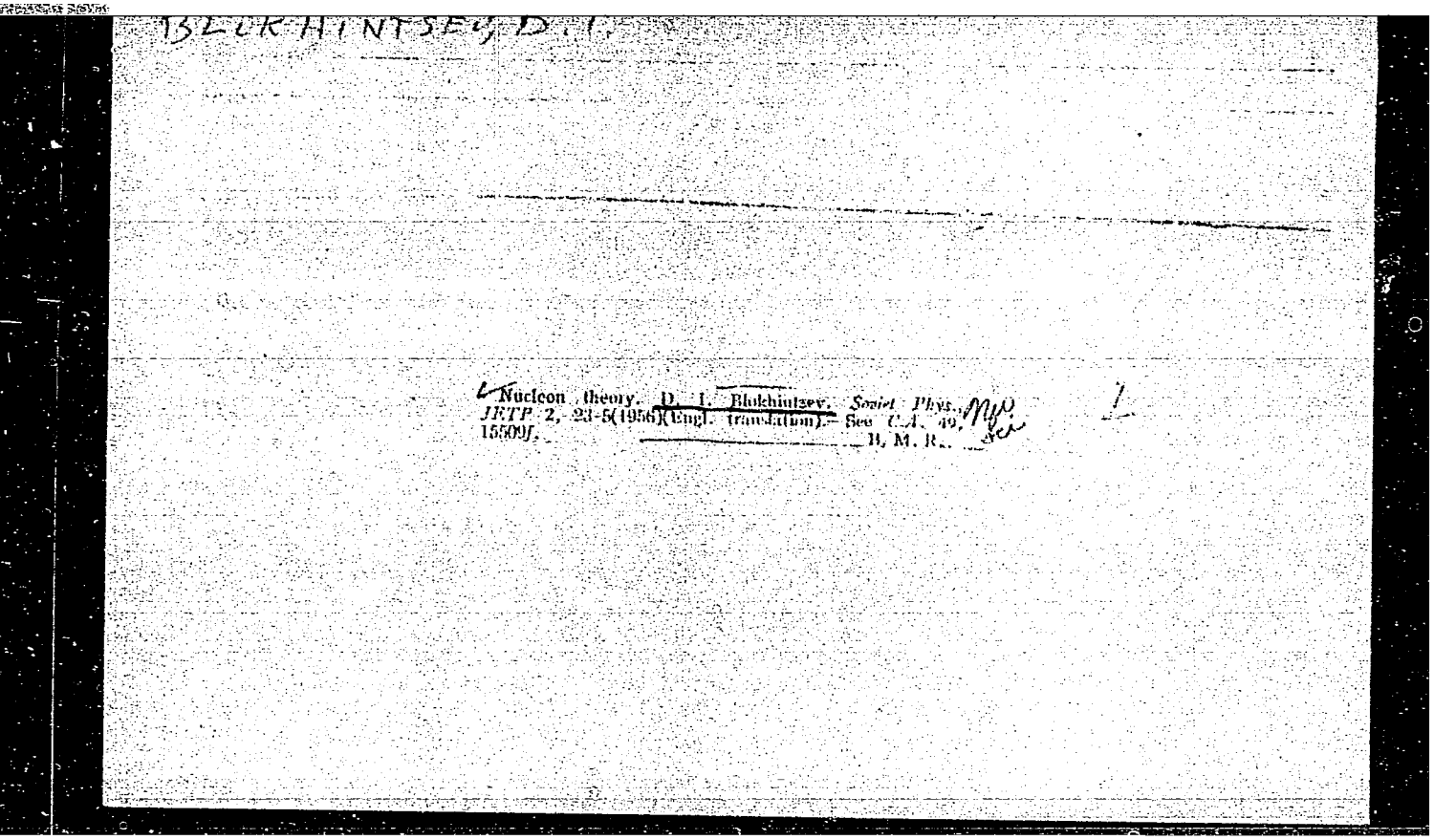
Abstract : The initial quantities in the design of the reactor of the atomic electric station of the Academy of Sciences of the USSR were the useful power (5,000 kw) and the refueling cycle, which first was determined to be 100 days. In addition, it was required that the construction of the fuel elements be designed for a minimum U^{235} enrichment. The purpose of the physical calculations was to refine the dimensions of the reactor, to determine the excess reactivity, and to design the control and protection systems. The calculations for the reactor were based on the age theory. The purpose of the thermal calculations was to determine the temperature operating conditions of the individual units of the reactors, primarily of the fuel elements, under various operating conditions of the reactor:

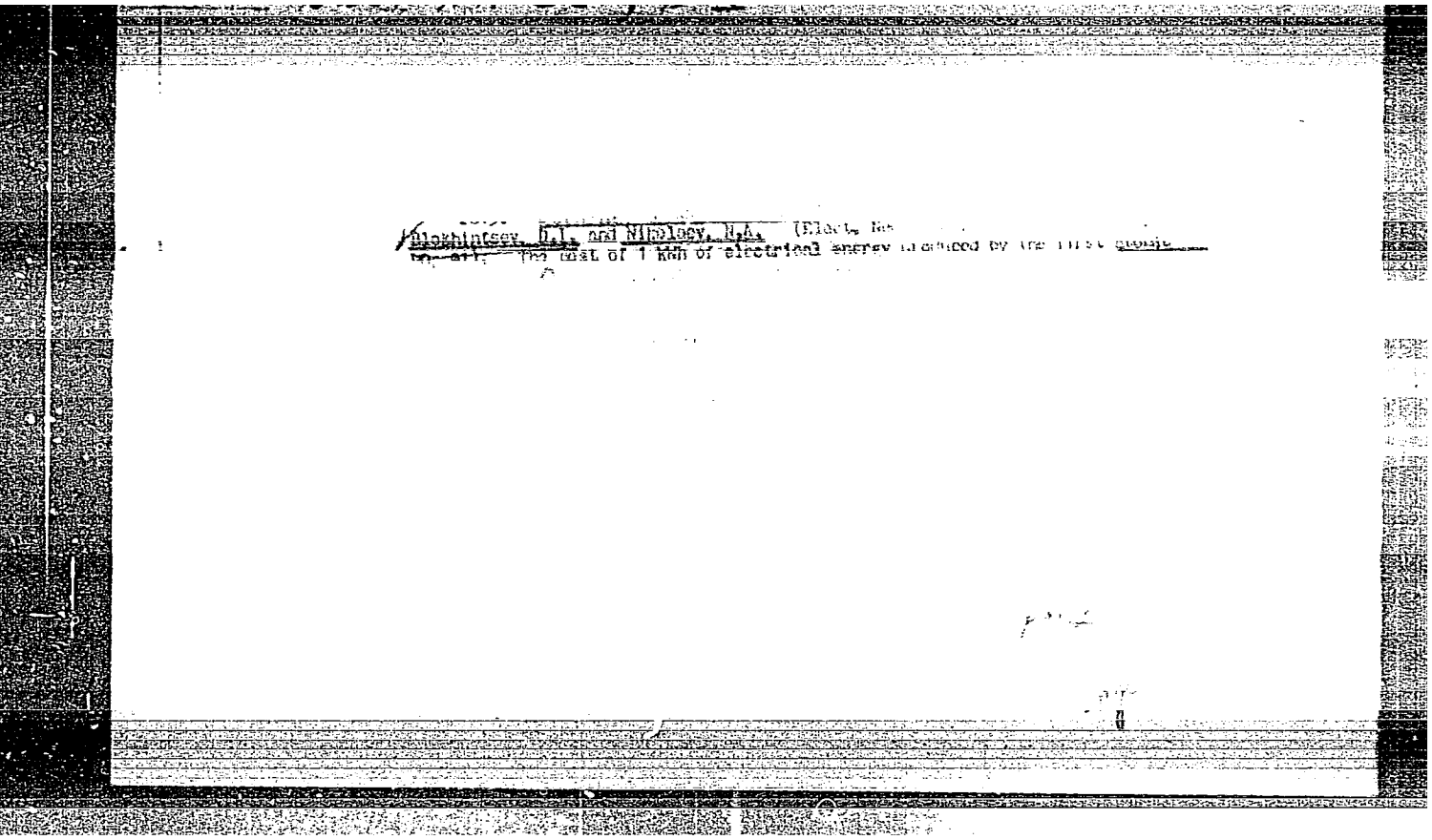
Card : 1/2



Blokhintsev, D.I.

The physical and technical foundations of atomic energy.
... Fiz. Znan. 1, 200-25(1956) (in ...
... brief theoretical discussion, the ... construction by using ...
... the extent of the ...
... will operate more economically and the kw.-hr. price of ... elec. energy will be competitive with that from ordinary ... for the exchange liquid ... therefore liquid metals ... Pb-Bi). The liquid ... electromagnetic pumps ... requiring moving parts.





Blokhintsev, D.I. and Nikolaev, N.A. [illegible]
the cost of 1 kWh of electrical energy [illegible]

BLOKHINTSEV, D.

"8.3 Billion Electron-Volts," by Prof D. Blokhintsev (USSR), director of the Joint Institute of Nuclear Research; Prof V. Votruba (Czechoslovakia), vice-director; and Prof M. Danysh, (Poland), vice-director; Moscow, Pravda, 11 Apr 57

The following is the text of a telephone communique datelined Dubna, 10 April:

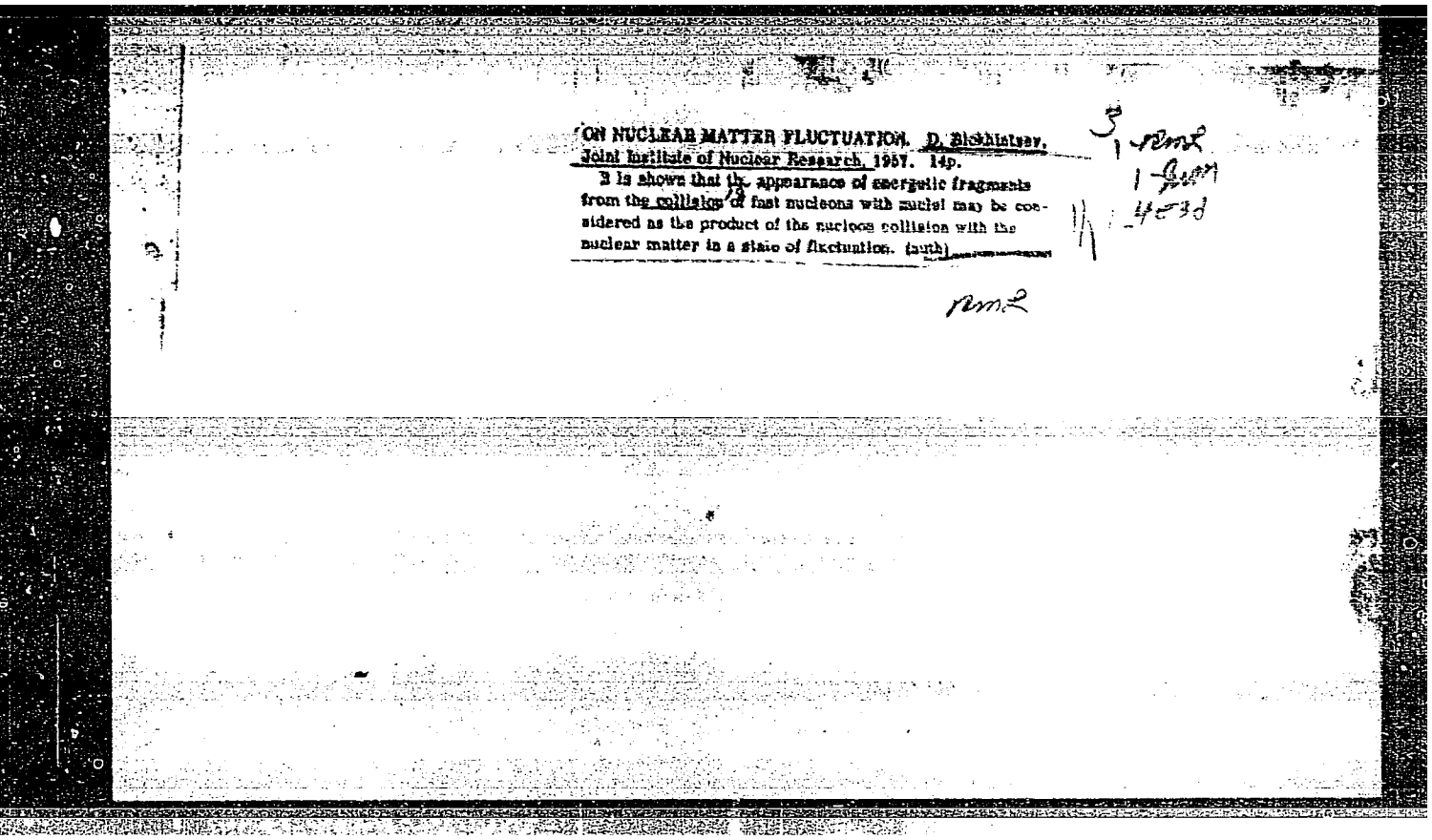
"The synchrophasotron installed in the Laboratory of High Energy Physics, Joint Institute of Nuclear Research, has begun operation. Protons have already been accelerated to energies of 8.3 billion electron-volts with this installation.

"The highest particle energy which physicists have ever achieved artificially has been attained.

"Setting the synchrophasotron of the joint institute in operation will create excellent opportunities for completing a broad program of scientific research. The members of the Joint Institute of Nuclear Research come from 12 states and have equal status.

"Work continues on further adjustments of the synchrophasotron and in further increasing the energy of the particles accelerated in it to 10 billion electron-volts." (U)

Sum. 1375



ON NUCLEAR MATTER FLUCTUATION. D. Blokhintsev. Joint Institute of Nuclear Research, 1957. 14p.

It is shown that the appearance of energetic fragments from the collision of fast nucleons with nuclei may be considered as the product of the nucleon collision with the nuclear matter in a state of fluctuation. (auth)

chapter deals with one particular problem and gives a concise statement of the modern Soviet theory about it. Among the central topics dealt with in the book are power generation through nuclear reactors, physics and the application of semiconductors, the development of new high-energy particles and radioelements, and changes brought about in production engineering by the ever increasing use of radioactive substances. Radiation effects in the auroral zone of the Arctic, television transmitters aboard Earth satellites, and technological aspects of high-pressure phenomena also come within the scope of this collection. The book contains diagrams, photographs, and a few scattered Soviet references in the text.

TABLE OF CONTENTS:

AVAILABLE: Library of Congress

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5-29-59

Card 5/5

BLOKHINTSEV, D.I.

AUTHOR LEYPUNSKIY, A.I., BLOKHINTSEV, D.I., ARISTARKHOV, I.N., 89-6-1/24
BONDARENKO, I.I., KAZACHKOVSKIY, O.D., PINKHASIK, M.S., STAVISSKIY, Yu.Ya.
STUMBUR, E.A., UKRAINTSEV, F.I., USACHEV, L.N.

TITLE The Experimental Reactor for Fast Neutrons BP - 2.
(Eksperimental'nyy reaktor na bystrykh neytronakh BP-2-Russian)

PERIODICAL Atomnaya Energiya, 1957, Vol 2, Nr 6, pp 497-500 (U.S.S.R.)

ABSTRACT This reactor is intended to be used for physical investigations with fast neutrons. At first the active zone of the reactor is discussed. The heat-separating elements of the reactor BP-2 consist of plutonium rods of 10 mm diameter and 130 mm length. Besides the plutonium rods there are similarly constructed rods in the active zone which are made of poor uranium. Altogether there are 108 uranium- and plutonium rods which are mounted in a steel tube with an inner diameter of 130 mm. The reflector of the reactor consists of an uranium layer (outer diameter 700 mm) and a coper layer (outer diameter 1000 mm). The reactor is controlled by a control system and by an emergency system. The operating control organs are part of a screen which are located near the active zone. The control system also contains boron-ionization chambers, an electronic apparatus, and servofeeds. The emergency system enters into operation if the prescribed or assumed power of the reactor is exceeded. Circulating mercury is used for the system of heat conduction. This mercury is then cooled in a heat exchanger with water. The radiation protection of the reactor consists of the following parts: a) a water layer of 300 mm thickness b) a cast iron layer of 400 mm

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The Experimental Reactor for Fast Neutrons BP - 2. 89-6-3/24

thickness c) a layer of heavy concrete of 1200 mm thickness. A special laboratory building was erected for the purpose of housing the reactor and its auxiliary installations.
Experimental Installations: The central experimental channel is determined for the irradiation of samples with strong fluxes of fast neutrons. In the experimental channels in the lateral reflector of the reactor also samples are irradiated, but also a local oscillator may be fitted. Three horizontal channels serve the purpose of conveying bundles of fast neutrons through the protective casing of the reactor. The reactor furthermore contains a thermal column of graphite, the dimensions of which are 1400 x 1400 x2600 mm. In conclusion the applicability of this reactor is discussed; in particular physical constants are determinèd precisely.
(3 illustrations).

ASSOCIATION Not Given.
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Card 2/2

BLOKHINTSEV, D.I.; NIKOLAYEV, M.A.[Nikolaiev, M.A.]

First atomic energy plant in the U.S.S.R. and the development of atomic power engineering. Dos. such. fiz. no.5:13-49 '57. (MIRA 16:6)

(Russia—Atomic power plants)

BLOKHINTSEV, D. I.

BLOCHINCEV, D.I. [Blokhintsev, D.I.]

Peaceful use of the nuclear energy. Jaderna energie 3 no.8:225-231 Ag '57

1. Spojeny ustav pro jaderny vyzkum, Dudna, S.S.S.R.

Blochincev, D.I.

CZECHOSLOVAKIA/Nuclear Physics - Nuclear Power and Technology C-8

Abs Jour : Ref Zhur - Fizika, No 5, 1958, No 10308

Author : Lejpunskij, A.I., Blochincev, D.I., Aristarchov, I.N., Bondarenko, I.I., Kazackovskiy, O.P., Pinchasik, M.S., Stavissky, Ju.Ja., Stumbur, E.A., Ukrajincev, F.I., Usacev, L.N.

Inst : Not Given

Title : Soviet Experimental Fast Neutron Reactor BR-2.

Orig Pub : Jaderna energie, 1957, 3, No 8, 231-233

Abstract : Translation from the Russian. See Referat Zhur Fizika, 1958, No 1, 597

Card : 1/1

Blokhintsev, D.I.

4-11-11/34

AUTHOR: Blokhintsev, D.I., Doctor of Physico-Mathematical Sciences, Director of the United Institute for Nuclear Research, and Laureate of the Lenin Prize

TITLE: Young Friends! (Yunyye druz'ya!)

PERIODICAL: Znaniye - Sila, 1957, # 11, p 11 (USSR)

ABSTRACT: A short appeal to the Soviet youth in which the author emphasizes the excellent working possibilities the scientists have at the institutes of the USSR. There is 1 figure.

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy (United Institute for Nuclear Research)

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BLOKHINTSEV, D.I.

USSR/Nuclear Physics - Elementary Particles C-3

Abs Jour : Ref Zhur - Fizika, No 1, 1958, 415

Author : Blokhintsev, D.I.

Inst : Atomic Station, Academy of Sciences, USSR

Title : Scattering of Fast Protons by Protons.

Orig Pub : Zh. eksperim. i teor. fiziki, 1957, 32, No 2, 347-349

Abstract : Using the coordinate representation, the author investigates the singularity of the principal portion of the interaction of two protons in a state with a total momentum J 0. Qualitative considerations (using the Born approximation) are used to show that only a potential that is the reciprocal of the third power of the distance between protons, can be reconciled with the experimental data on the scattering of fast protons by protons. The results are given of a numerical calculation of the cross section

Card 1/2

AUTHOR BLOKHINTSEV D.I. PA - 2683

TITLE Some Remarks on the Validity of the Hydrodynamic Description of Quantum Systems.
(Zamechaniya o primenimosti gidrodinamicheskogo opisaniya k kvantovym sistemam - Russian)

PERIODICAL Zhurnal Eksperim. i Teoret.Fiziki, 1957, Vol 32, Nr 2, pp 350 352 (USSR)
Received 5/1957 Reviewed 6/1957

ABSTRACT The present work investigates the characteristic limitations of a quantum-like system and shows that the hydrodynamic description of the system imposes considerable limitations on the dimensions of the system discussed. Be it assumed that the momentum in the volumen element Δx^3 amounts to $g\Delta x^3$. On the other hand, the inequation Δx is valid for the dispersion Δp of the momentum connected with the localization of the matter within $\Delta p > \hbar/\Delta x$. To be able to describe the motion by means of momentum density, the average value of the momentum $g\Delta x^3$ must be larger than the possible dispersion, i.e. $g\Delta x^3 \gg \hbar/\Delta x$ or $g \gg \hbar/\Delta x^4$ must apply. As the energy density in the nonrelativistic case amounts to $\mathcal{E} = g^2/2\rho$, $\mathcal{E} \gg n^8\hbar^2/2L^8$ must apply. In the relativistic case it hold that $\mathcal{E} \sim gc$, and therefore $\mathcal{E} > n^4\hbar c/L^4$. These relations for energy can also be obtained from the relation $\Delta E \Delta t > \hbar$ for $\Delta t \sim \Delta x/v$ or $\Delta t \sim \Delta x/c$. Subsequently, these inequations are applied in two concrete cases:
A. The hydrodynamic description of the atomic nucleus: Here the nonrelativistic inequation is applied to the total energy $E \sim \mathcal{E}V$ of the excitations of the nucleus caused by hydrodynamic motions.

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Some Remarks on the Validity of the Hydrodynamic Description of Quantum Systems. PA - 2683

$E \gg n^8 \hbar^2 v^2 / 2R^8 mA = (1/2)(4\pi/3)^2 n^8 (\hbar^2/2\, mr_0^2)\, A^{-5/3}$ is obtained.

An enormous excitation energy is obtained which makes it impossible for the nucleus to exist as a whole. Therefore, the computed moment of inertia resulting from the motion of an ideal liquid in an ellipsoidal container is probably in no relation whatever to reality.
B. The hydrodynamic description of the multiple production of mesons: Immediately after collision of the nucleons a hydrodynamic description of this process is quite impossible. The multiple production of mesons must in reality be looked upon as a purely quantum mechanical phenomenon

ASSOCIATION Atomic Station of the Academy of Science of the USSR
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SUBMITTED 12.2.1956
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Card 2/2

Blokhintsev, D.I.

AUTHOR: Blokhintsev, D.I. 56-5-37/46

TITLE: On the Fluctuations of Nuclear Matter (O fluktuatsiyakh yadernogo veshchestva)

PERIODICAL: Zhurnal Eksperim. i Teoret.Fiziki, 1957, Vol. 33, Nr 5, pp. 1295-1299 (USSR)

ABSTRACT: With scattering of 675 MeV protons by deuterons it was experimentally stated that besides the scattered nucleons also whole, not destroyed deuterons of high energy (up to 660 MeV) occur. By this it is proved that at these collisions the nucleon transfers an important part of its momentum to the deuteron as a whole. It is now theoretically generally proved that the occurrence of highly energetic particles in nucleon collisions with nuclei can be looked upon as the result of a nucleon collision with the fluctuation of the nuclear matter. The cross sections computed in this manner for Li, Be, C, and O compared to deuteron emission agree satisfactorily with the known data. There are 6 references, 4 of which are Slavic.

ASSOCIATION: United Nuclear Research Institute (Ob"yedinennyy institut yadernykh issledovaniy)

SUBMITTED: July 1, 1957
AVAILABLE: Library of Congress

Card 1/1

PA - 2284

AUTHOR: BLOKHINTSEV,D.I.

TITLE: The Non-Local and Non-Linear Field Theories. (Nelokal'nyye i nelineynyye teorii polya, Russian).

PERIODICAL: Uspekhi Fiz. Nauk, 1957, Vol 61, Nr 2, pp 137 - 159 (U.S.S.R.)
Received: 4 / 1957 Reviewed: 5 / 1957

ABSTRACT: According to the author's opinion the theory of renormalization is only a relatively successful way for avoiding the main difficulties of the present theory. Among the attempts at modification resulting from physical modification those in non-local and non-linear fields occupy a special position. In both theories a certain elementary length s_0 is introduced.

At first some varieties of the non-local field theory are discussed. The non-local theory interaction in the vacuum is able to propagate also with a velocity greater than that of light. Also in the non-local theory an integral of motion and an analogy to the HAMILTONIAN can be found. In spite of this fact, a theory of the HAMILTON form is, however, not possible. An asymptotic, quantum-like theory may, however, apply. In accordance with HEISENBERG nearly all varieties of the non-local theory in some way or another try to determine the scattering matrix of the non-local theory. As an example the non-local theory of the electromagnetic field with two-point - form-factor $F(p - p')$ is investigated.

The non-local theory of the field: At first BORN's theory is dis-

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The Non-Local and Non-Linear Field Theories.

cussed in short. Also in the case of the present canonic field theory the insertion of an interaction leads to non-linear field equations, which, however, are only approximated equations and contain derivations of a high order. A classical, non-linear theory, however, cannot be the aim of theoreticians because the quantum-like phenomena become manifest much earlier than non-linearities. The non-linear theory must be quantized, but just in the case of quantization the main difficulties occur. Here the classification of the non-linear equations (restricted to the LAGRANGIAN) is discussed. The non-linear theory is divided into two classes: One class (propagation of the signals with a velocity higher than that of light) has much in common with the non-local theories and in this case the HAMILTONIAN cannot be applied. The other class (signal velocity is always lower than light velocity) does not contradict the usual conception of causality, and therefor the HAMILTONIAN and perhaps also the usual scheme of the quantization can be applied.

In conclusion there follows a report on the physics of strong interaction. Some examples are discussed. Among others, the energy of the "compound particles" is probably concentrated in the energy of interaction and not in the particles' own energy. (3 illustrations).

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PA - 2284

The Non-Local and Non-Linear Field Theories.

ASSOCIATION: Not given
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AVAILABLE: Library of Congress

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Blokhintsev, D.I.

53-3-10/10

AUTHOR: BLOKHINTSEV, D.I.

TITLE: When does a weak interaction change into a strong one?
(Kogda slabqye vzaimodeystviye stanovitsya silhym?)

PERIODICAL: Uspekhi Fiz. Nauk 1957, Vol 62, Nr 3, pp 381-383 (USSR)

ABSTRACT: By "strong" interaction we understand one during the duration of which the article has its energy concentrated in form of interaction energy and not as its own kinetic energy.
As a supplement to the author's article Uspekhi Fiz. Nauk 1957, Vol 61, p 137, the interaction of a neutron and an electron is investigated here, on which occasion the electron is transformed into a μ-meson. ($\gamma + e \longrightarrow \mu + \nu'$) for this "weak interaction process it is proved theoretically that, in accordance with the above definition, it could also be a "strong" one.

ASSOCIATION: not given.
PRESENTED BY: -
SUBMITTED: -
AVAILABLE: Library of Congress.

CARD 1/1

BLOKHINTSEV D.I.

FRENKEL', Yakov Il'ich, [deceased 1945]; SEMENOV, N.N., akad. otv. red.; SOKOLOV, A.A. doktor fiz.-mat. nauk, red.; BOGOLYUBOV, N.N., akad., red.; TAMM, I.Ye., akad., red.; ANSEL'M, A.I., doktor fiz.-mat. nauk, red.; BLOKHINTSEV, D.I., doktor fiz.-mat. nauk, red.; KONTOROVA, T.A., kand. fiz.-mat. nauk, red. izd-va.; SMIRNOVA, A.V., tekhn. red.

[Selected works] Sobranie izbrannykh trudov. Moskva, Izd-vo Akad. nauk SSSR. Vol. 2. [Scientific articles] Nauchnye stat'i. 1958. 600 p. (MIRA 11:11)

1. Chlen-korrespondent AN SSSR (for Frenkel').
(Physics)

SOV/56-35-1-35/59

AUTHOR: Blokhintsev, D. I.

TITLE: On the Possible Limit of the Application of Quantum-Electrodynamics (O vozmozhnom predele primenimosti kvantovoy elektrodinamiki)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol. 35, Nr 1, pp. 254-257 (USSR)

ABSTRACT: In his introduction the author discusses difficulties and possibilities of applying modern methods of quantum-electrodynamics to various processes. At high energies, operating with four-fermion interactions is found useful for certain processes. In the present paper the following processes are investigated:
a) The interaction of a photon (k) with an electron (e): $k + e \rightarrow \mu + \nu + \tilde{\nu}$, for the Lagrange- (Lagranzh-) interaction W of which the following ansatz is made: $W = eW_e + eW_\mu + gW_{\mu e \nu}$ (in words: W = interaction of the electron + interaction of the myon + four-fermion interaction of electron, myon and neutrino); $g = \hbar c \Lambda_0^2 \approx 10^{-49}$ erg.cm^3 is the Fermi constant

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On the Possible Limit of the Application of Quantum-Electrodynamics

SOV/56-35-1-35/59

($\Lambda_0 = 6.10^{-17}$cm). For the total effective cross section the following is finally obtained: $\sigma_\mu \sim \alpha \Lambda_0^4 k^2 F$, the factor F is of the order 1 and is characterized by a slight dependence on k (in this connection the author thanks Dr. M. Meyer (Romania) for the detection of this dependence).
b) The process of the collision of two electrons $e' + e'' \rightarrow \mu' + \mu''$ with differential cross section (c.m.s.).

$$d\sigma_{\mu\mu} \simeq \Lambda_0^8 q^4 p^2 F d\Omega$$

q = transmitted momentum and p = the primary momentum of the electron measured in reciprocal lengths. Further, the cross sections for pure electromagnetic processes are given, viz. for the Compton effect, for the elastic collision of electrons ($d\sigma_{ee} = \alpha^2 (p^2/q^4) d\Omega$), for the production of pairs and the bremsstrahlung at the collision of electrons. In conclusion the various cross sections for the mixed processes a) and b) are compared.

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On the Possible Limit of the Application of Quantum-Electrodynamics

SOV/56-35-1-35/59

There are 3 references, all of which are Soviet.

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy (United Institute of Nuclear Research)

SUBMITTED: February 28, 1958

Card 3/3

AUTHORS: ~~Blokhintsev, D. I.,~~ Barashenkov, V. S., Grishin, V. G. SOV/56-35-1-59/59

TITLE: The Diffraction Scattering of Fast Particles (Diffraktsionnoye rasseyaniye bystrykh chastits)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol. 35, Nr [redacted] pp. 311 - 312 (USSR)

ABSTRACT: The structure of elementary particles may be studied by investigation of the elastic scattering of any radiation by these particles. Hitherto only the investigations carried out by the Hofstadter (Khofshtadter) group concerning the scattering of electrons on nuclei and nucleons are known, they permit the determination of the form factor of the electric charge and of the magnetic moment. But also the analysis of the elastical scattering of other particle types makes it possible to obtain important information concerning the structure of the nucleons and nuclei. This paper investigates, as an example, the scattering of negative pions on nucleons. For the sake of simplicity, the dependence of the interaction on the spins and the

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"charge exchange" are neglected. Moreover, it is assumed that the real part of these phases is equal to zero: $\mathrm{Re}\,\eta_1 = 0$. The exact solution of this problem will be published later. A diagram demonstrates the values of $\mathrm{Im}\,\eta_1$ for the scattering of negative 1,3 BeV pions. For high energies the quasiclassical approximation may be used with a high degree of approximation. The numerical values of the cross section which were calculated according to the quasiclassical theory agree rather well with the results of previous papers and this is one of the arguments in favor of the applicability of the quasiclassical approximation. For the average square "pion radius" of a nucleon the value $(0{,}82 \pm 0{,}06) \cdot 10^{-13}$ cm was found; it corresponds (within the limits of experimental errors) to its value for E = 5 BeV. The example investigated in this paper is a special case of the so-called inverse problem of the scattering theory: from the given scattered wave the interaction potential is to be determined. The authors thank K. Danilov for his help in numerical computations. There are 2 figures and 6 references, 2 of

The Diffraction Scattering of Fast Particles SOV/56-35-1-59/59

which are Soviet.

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy (United Institute of Nuclear Research)

SUBMITTED: April 23, 1958

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21(1) SOV/26-59-9-3/37

AUTHOR: Blokhintsev, D.I., Corresponding Member of the AS USSR

TITLE: Recent Concepts of the Electron

PERIODICAL: Priroda, 1959, Nr 9, pp 25-29 (USSR)

ABSTRACT: Ever since the existence of electrons was established, physicists have speculated as to their structure. This article is a historical survey on the structure of the electron and the nucleon (see also fig.1 and 2) in the last 30-40 years. The author states that the structure of the electron was satisfactorily formulated, but not yet solved. Neither M. Born's theory nor the quantum theory of electrons could solve the problem. But the latter created the so-called "quantum radius of the electron" which is connected with the Compton wave length of the electron (also the de Broglie wave length). This radius is equal to 10^{-70} cm.

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Recent Concepts of the Electron

The corresponding member of the AN SSSR (AS USSR), M.A. Markov, stated that this radius is even smaller than the gravitational length. In fact, the gravitational radius of the electron is bigger than the quantum radius which is shown by the formula

$$a_r = \frac{k m \sigma}{c^2} \cong 10^{-55} \text{ cm}$$

(where k is the gravitational constant). Since then, many physicists thought that the structure of the electron could not be solved without the gravitation theory. Nevertheless, even this idea was not successful. There are 2 diagrams and 1 Soviet reference.

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy/Dubna (Joint Nuclear Research Institute/Dubna)

Card 2/2

21(1)

AUTHORS: Blokhintsev, D. I., Barashenkov, V. S., SOV/56-36-5-73/76
Barbashov, B. M.

TITLE: The Electromagnetic Structure of the Proton and of the Neutron (Elektromagnitnaya struktura protona i neytrona)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 36, Nr 5, pp 1611-1612 (USSR)

ABSTRACT: The experimental results of the distribution of charge and magnetic moment in the nucleon are known to be in sharp contradiction to meson-theoretical calculations. The authors of the present "Letter to the Editor" are, however, of the opinion that the difficulties are mainly due to an inaccurate interpretation of the fact that the usual interpretation of Hofstadter's experiments is actually neither unique nor accurate, but only possible. The discrepancy said to exist between the distribution law of meson charge density according to Yukawa ($\sim e^{-\alpha r}/r^2$) and the experimental one ($\sim e^{-\beta r}$) is of no real importance

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because the ranges of applicability of these expressions are quite different. Proceeding from the expressions found by Salzman (Ref 1) for the total charge density $\rho(r) = \rho_\pi(r) + \rho_k(r)$ and from the magnetic moment of the meson cloud $m(r) = m_\pi(r) + m_k(r)$ (one-pion state), the cutoff method is briefly investigated, and for the electric radius of the pion cloud $\langle r_e^2 \rangle_\pi = 0.19(\hbar/\mu_\pi c)^2$, and for the magnetic radius $\langle r_m^2 \rangle = 0.40(\hbar/\mu_\pi c)^2$ is obtained; for the charge of the pion cloud $Q_\pi = 0.76$ e and for the magnetic moment $m_\pi = 1.25\ e\hbar/2Mc$ is obtained. The distribution of charge and magnetic moment in the core amounts to $\rho_k(r) = (Q_k/8\pi a^3)e^{-r/a}$ and $m_k(r) = (m_k/8\pi a^3)e^{-r/a}$; Q_k denotes the charge of the core, and m_k - its magnetic moment. It is known from experiments that for the neutron

The Electromagnetic Structure of the Proton and of the Neutron SOV/56-36-5-73/76

$\langle r_e^2 \rangle_n \approx 0$; the anomalous magnetic moment of the nucleon was experimentally determined as being $m_N = \tau_3 . 1.85 e\hbar/2Mc$, $Q_k = (1 + \tau_3)/2 - Q_\pi$. Thus $\langle r_e^2 \rangle_p = \langle r_m^2 \rangle_n = \langle r_m^2 \rangle_p = (0.7f)^2$ is obtained, which agrees well with the experiment. A figure shows the charge distribution d(r) for proton and neutron and their cores. The statement made by the authors shows that the result obtained by Hofstadter may be considered to agree very satisfactorily with the results of the meson theory. There are 1 figure and 4 references.

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy (Joint Institute of Nuclear Research)

SUBMITTED: March 5, 1959

Card 3/3

21 (1)

AUTHORS: Blokhintsev, D. I., Barashenkov, V. S., Barbashov, B. M. SOV/53-68-3-5/11

TITLE: The Structure of Nucleons (Struktura nuklonov)

PERIODICAL: Uspekhi fizicheskikh nauk, 1959, Vol 68, Nr 3, pp 417-447 (USSR)

ABSTRACT: In chapter 1 (introduction) the authors discuss Mkawa's Theory of nucleon interaction by means of a meson field as well as the physical model of a nucleon represented by figure 1 with core, pion, and K-meson shell; the core dimension is given as amounting to $\sim\hbar/Mc = 2.1\cdot10^{-14}$ cm. In the following chapter 2 the methods of investigating particle structure are dealt with. Besides the recoil effect the inelastic interaction processes are discussed in detail. Table 1 shows the statistical errors of cross section measurements of inelastic collisions of p and n with Fe-nuclei at high energies for four energy intervals. The "gray" and "black" domains in the nucleon are dealt with (Fig 2). Some other methods are mentioned and a table shows the wave lengths of various rays. In chapter 3 the electromagnetic structure of the nucleon is theoretically dealt with, and the theory developed by Chew and Low is especially taken into account. Table 3

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represents the distribution of the electric charge in the pion cloud of the nucleon. The most important experimental results are given separately for proton and neutron. Chapter 4 is entitled "Critical Remarks and an Analysis of the Experiments Carried out by Hofstadter"; in the individual parts the limits of electrodynamics, the part played by inelastic processes, and the analysis of the scattering of electrons on protons and neutrons is discussed. Figure 6 shows the electromagnetic structure of protons and neutrons in form of diagrams. The curves $d_p(r)$ and $d_n(r)$ were taken from papers by Hofstadter. Chapter 5 deals with some structural effects of nucleons. Two problems connected with the electromagnetic structure of nucleons are discussed: the electric polarizability of the electron cloud in the nucleon according to Chew; the factor α of $\vec{p} = \alpha\vec{E}$ is given as amounting to $4 \cdot 10^{-43}$ cm$^3 \leq \alpha \leq 1.4 \cdot 10^{-42}$ cm^3, which is lower than the value given by Yu. A. Aleksandrov. In the second part of this chapter the electromagnetic mass of the nucleons and the stability of protons (according to reference 59) are investigated. Chapter 6 deals with theoretical experiments

carried out for the purpose of interpreting the electromagnetic structure of the central nucleon ranges. Whereas in the preceding chapters the peripheral ranges of nucleons were dealt with; the following chapters deal with the theory of central parts. Individually, the influence of strange particles, the contribution of nucleon-antinucleon pairs (according to I. Ye. Tamm, figure 8), and some details of the theory of the form factors and dispersion relations are dealt with. Chapter 7 deals with the nuclear structure of nucleons. Several problems connected with the electromagnetic interaction of nucleons in the nucleus (nucleons among themselves, nucleons with pions, K-mesons, and antinucleons) are investigated. The cores of the nucleons are briefly dealt with (several experimental results obtained at the OIYaI (Joint Institute of Nuclear Research) are given. - Figure 10: Histograms of pp- and pn-collisions at 9 Bev (proton synchrotron) are given. The optical model of the nucleon is discussed in detail and so is pion-pion interaction. In chapter 8 the authors deal with the theory of the optical nucleon model: the equation for pion-nucleon scattering is given and discussed, and so are the conditions for the occurrence of a complex potential. Chapter 9 finally gives quite a short

summary. The material of this survey is mainly of Western origin. There are 12 figures, 5 tables, and 60 references, 27 of which are Soviet.

30(9),21(1)
AUTHOR: Blokhintsev, D. I. SOV/53-69-1-1/11

TITLE: V. I. Lenin's Book "Materialism and Empiriocriticism" and Present Day Conceptions on the Structure of Elementary Particles (Kniga V. I. Lenina "Materializm i empiriokrititsizm" i sovremennyye predstavleniya o strukture elementarnykh chastits)

PERIODICAL: Uspekhi fizicheskikh nauk, 1959, Vol 69, Nr 1, pp 3-12 (USSR)

ABSTRACT: The present article is the reproduction of a lecture delivered by the author on the occasion of the fiftieth anniversary of the publication of Lenin's book "Materialism and Empiriocriticism" in April 1959 at Bucharest University. - In his introduction he briefly mentions some of Lenin's theses and opinions concerning physics. Chapter 2 deals with the history of the discovery of the electron and with the varying conceptions formed of these particles in the course of time, as well as with some methods of getting to know the nature of the electron. Also the method of renormalization is dealt with, and L. D. Landau's successes are stressed. In chapter 3 the structure of the electron is described in accordance with modern conceptions (Shell structures; Figure 1 shows the shells of the virtual

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particles with the corresponding measurements from the outside to the inside: electrons, positrons - 10^{-11}cm, pions - 10^{-13}cm, nucleons, antinucleons - 10^{-14}cm, "weak interaction"- 10^{-16}cm, gravitational range - 10^{-70}cm). Chapter 4 deals with nucleon structure (pion atmosphere - 10^{-13}cm, zone of K-mesons and pion pairs - 10^{-14}cm, core zone of nucleon-antinucleon pairs 10^{-14}cm. Theory by Hofstadter). Chapter 5 finally is devoted to modern conceptions of micro- and macrocosmos. Among other things, the theory of cosmos and "anticosmos" is briefly dealt with. There are 2 figures.

BLOKHINTSEV, Dmitriy I., YUNG,

"Interactions in Collisions at High Energies of Pions"

paper presented at the Intl Conference on High Energy Physics, Rochester, N. Y. and/or Berkly California, 25 Aug - 16 Sep 1960.

Joint Institute for Nuclear Reserch, Dubna, USSR

BIRYUKOV, V.A.; LEBEDENKO, M.M.; RYZHOV, A.M.; BLOKHINTSEV, D.I., nauchnyy red.

[Joint Institute for Nuclear Studies] Ob"edinennyi institut iadernykh issledovanii. Moskva, Izd-vo Glav.upr. po ispol'zovaniiu atomnoi energii pri Sovete Ministrov SSSR, 1960. 114 p. (MIRA 13:12)

1. Chlen-korrespondent AN SSSR (for Blokhintsev).
(Dubna--Nuclear research)

BLOKHINTSEV, D.

Remark pertaining to the optical theorem. Zhur. eksp. i teor. fiz. 39 no.4:1153-1154 O '60. (MIRA 13:11)

1. Ob"yedinennyy institut yadernykh issledovaniy.
(Electron optics)

BLOKHINTSEV, Dmitriy I

"Inelastic Scattering of Mesons in the One Meson Exchange Approximation."

report presented at the IUPAP sponsored Intl. Conf. on Theoretical Aspects of Very High Energy Phenomena, CERN headquarters, Geneva, 5-9 June 1961.

BLOKHINTSEV, D.I.

Diffraction πN -scattering and spatial nucleon structure. Dubna, Izdatel'skii otdel Ob"edinennogo in-ta iadernykh issledovanii, 1961. 11 p.
(No subject heading)

BLOKHINTSEV, Dmitriy Ivanovich; TAL'SKIY, D.A., red.; PAVLOVA, V.A., tekhn. red.

[Fundamentals of quantum mechanics] Osnovy kvantovoi mekhaniki. 3., izd. Moskva, Gos. izd-vo "Vysshaia shkola," 1961. 511 p. (Quantum theory) (MIRA 14:10)

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BLOKHINTSEV, D. I., BLOKHIN, G. B., BLYUMKINA, Y. A., BONDARENKO, I. I.

DERYAGIN, B. N., ZAIMOVSKIY, A. S., ZINOV'YEV, V. P., KAZACHKOVSKIY, O. D.

KRAZNOYAROV, N. V., ~~LEYPUNSKIY~~ LEYPUNSKIY A. I., MALIKH, V. A., NAZAROV, P. M., NIKOLAYEV, S. K., STAVISSKIY, Y. Y., UKRAINTSEV, F. I., FRANK, I. M. SHAPIRO, F. L., YAZVITSKIY, Y. S.

"A Pulsed fast reactor."

report submitted for the IAEA Seminar on the Physics of Fast and Intermediate Reactors, Vienna, 3-11 Aug 1961.

Acad Sci. USSR Moscow

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D218/D306

AUTHOR: Blokhintsev, D.I.

TITLE: Five years' activities of the United Institute of Nuclear Research

PERIODICAL: Jaderná energie, no. 8, 1961, 253-264

TEXT: This is an abridged version of a report reviewing the activities of the Ob"yedinennyy institut yadernykh issledovaniy (United Institute of Nuclear Research) in Dubna which was presented by the Director of the Institute, Professor D.I. Blokhintsev at a meeting of delegates from member countries held in November 1960. The following highlights are listed: (1) Scientific activities of the institute: Emphasis was placed on research into high-energy physics which was facilitated by the installation of a 10 BEV synchro-cyclotron in 1957. Research into medium and low-energy physics was limited due to the lack of adequate equipment: It will be intensified in the near future since a pulsed fast reactor and a multiple-ion accelerator were completed in 1960. (2) Results

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Five years' activities...

of the Laboratory of Nuclear Problems during 1956-1961: (a) Extensive research was done on determining the so called isotopic invariance; (b) The coefficient f of the interaction of mesons and nucleons was determined with a fair degree of accuracy; (c) Dispersion relations for scattering mesons on nucleons were experimentally proved; (d) A number of new data were obtained on the meson-nucleon interaction, e.g. the "non-central" nature of nuclear forces; the role of "spin-orbital" interaction; quantitative data on the polarization of nucleons at scattering, etc., (e) First data were obtained on the interaction of unstable particles, especially on the interaction of pi-mesons; (f) The spin of the pi-meson was measured for the first time; (g) The electron-radioactive decay of π^--meson was determined; (h) The excitation of the atom nucleus by pi-mesons, as predicted by D. Zarecki, was demonstrated in 1960; (i) A number of nuclear instruments were designed and built, including an automatic apparatus for measuring particle tracks; a hodoscopic system of original design; and a liquid-hydrogen bubble chamber. (3) Results of the Laboratory of High Energies:

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Five years' activities...

(a) During research into the elastic and inelastic nucleon-nucleon and pion-nucleon interactions in the region of high energies, a slight deviation of the π-meson track upon interaction with a proton was observed. This seems to confirm the theory, assuming the structure of a nucleon to consist of a solid "nucleus" (size about 10^{-14}cm) and a comparatively rarefied "meson atmosphere" (size about 10^{-13}cm); (b) In the research on the origin of strange particles the most important accomplishment was the discovery of a new positively charged particle - the antisigma-minus-hyperon ($\bar{\Sigma}^-$). Furthermore, cross-sections and angular distributions for the formation of the following strange particles were measured: Λ_o ; Σ ; K-mesons; and Ξ -hyperons. Experiments at this laboratory were performed with a 10 BEV synchro-cyclotron. In early 1960, a small annular cyclotron was put into operation to verify its accelerating principle. In summer 1960, a new linear accelerator was built. In addition, a number of bubble and diffusion chambers, scintillation and Cherenkov counters were installed. At the present time, experiments with the following beams are being conducted: (aa) A π^--meson beam with impulses up to 9 BEV/sec, using a 55-cm xenon, a 55-cm propane, and a 25-cm liquid-hydrogen chambers for detection; (bb)

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A beam of negatively charged particles with impulses up to 6 BEV/sec, using a 40-cm liquid-hydrogen chamber, a 50-cm Wilson chamber, and scintillation and Cherenkov counters; (cc) A beam of positively charged particles with impulses up to 5 BEV/sec for work with K^+ -mesons, using Cherenkov and scintillation counters; (dd) A beam of neutral K^0_2 -mesons, using large diffusion chamber; (ee) A beam of high-energy neutrons, using a 2-m diffusion chamber; (ff) A beam of high-energy neutrons, using fully-absorbing Cherenkov counters. (4) Results of the Laboratory of Neutron Physics: In June 1960, this laboratory received the IBR pulsed fast reactor, designed by the Institute of Physics at the State Committee for the Utilization of Atomic Energy, USSR. [Abstractor's note: The reactor was described in no. 5 of the journal Atomnaya energiya]. The laboratory engages in the following research: (a) Study of the IBR reactor; (b) Study of the energetic dependence of neutron-reaction cross-sections, especially neutron resonances; (c) Study of the molecules of liquid and solid substances by the method of elastic and inelastic scattering of slow neutrons. (5)

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Five years' activities...

Results of the Laboratory of Nuclear Research: This laboratory concentrates on synthesizing the element 102. In the fall of 1957, the isotope 102^{253} was synthesized. The research is conducted by a group of scientific workers of the Institute of Atomic Energy imeni I.V. Kurchatov in Moscow. In 1960, the laboratory received a multiple-ion accelerator which will permit experiments with complex and heavy ions. (6) Results of the Laboratory of Theoretical Physics: The laboratory is staffed with 88 theoretical physicists. The laboratory engages in the following research: (a) Development of basic theoretical principles, and evaluation and interpretation of experimental results obtained by other laboratories; (b) N.N. Bogolyubov of this laboratory worked out a theory on superconductivity in connection with the atom nucleus; ✓ (c) In the field of particle theory, a basic particle model was proposed and worked out by N.A. Markov; (d) Interesting results were obtained in the neutrino theory in cooperation with B.M. Pontecorvo of the Laboratory of Nuclear Problems. (7) A computing center is attached to the Laboratory of Theoretical Physics. It is equipped with a "Ural 1" and a new "Kiyev" electronic computer.

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(8) Currently, the institute has five laboratories with a total of 420 scientific workers and engineers, of whom 220 are from the USSR and 200 from the other member countries. In 1961, a branch of the Physics Department of the Moscow State University imeni N.V. Lomonosov will be detached to the institute. (9) International cooperation: The institute closely cooperates with the scientific organizations of its member countries, especially in analyzing and evaluating experiments with nuclear emulsions irradiated by the institute's accelerators, and of photographs obtained from the bubble chambers. The cooperation in this department is coordinated by a special committee headed by Professor Václav Petržílka. Analysis and evaluation of the large number of photographs obtained from the recently installed propane and xenon bubble chambers which will continue increasing after additional large liquid-hydrogen and propane bubble chambers have been installed, will require the ever-increasing assistance of the scientific institutes of all member countries. Already engaged in this program are: The Institute of Nuclear Physics in Warsaw, headed by Professor Daniš;

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the Institute of Nuclear Physics, SZG, headed by K. Lanius; and the Institute of Physical Research in Budapest. Future activities of the institute will continue to concentrate on basic research into the physics of elementary particles and the atom nucleus with emphasis on the study of the structure of these particles, especially nucleons, and on the laws governing the formation and interactions of these particles. There are 20 figures. [Abstractor's note: Translator of this article J. Fuksa; Technical Editor: I. Ulehla]

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy, Dubna (United Institute of Nuclear Research, Dubna)

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AUTHOR: Blokhintsev, D. I.

TITLE: Five years of work of the Ob"yedinennyy institut yadernykh issledovaniy (Joint Institute of Nuclear Research)

PERIODICAL: Atomnaya energiya, v. 10, no. 4, 1961, 317-342

TEXT: In March 1961 the Joint Institute of Nuclear Research (Dubna) celebrated its 5th anniversary. For this reason, the opening address of Professor D. I. Blokhintsev, Director of the Institute, is published here, which he held in November 1960 to a committee consisting of representatives of the participating countries. It is a very detailed review of the efforts of the Institute (OIYaI) and of the successes which each laboratory has gained during the past five years. Numerous (irreproducible) photos go with it. The field of utmost endeavor of the Institute has always been high-energy physics. The most important work in this field is done by the following laboratories: Labcratoriya yadernykh problem (Laboratory for Nuclear Problems); Laboratoriya vysokikh energiy (High-energy Laboratory), which has been operating its own 10-Bev accelerator since 1958; Laboratoriya

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neytronnoy fiziki (Neutron-physics Laboratory); and the Laboratoriya yadernykh reaktsiy (Nuclear-reaction Laboratory), which has a powerful accelerator for multiply-charged ions since 1960. The following is a detailed description of work done by each laboratory. The most important achievements from 1956-1961 of the Laboratory for Nuclear Problems: The main task of this laboratory has been to investigate pion-nucleon interaction at several 100 Mev. It consisted in the following efforts: 1) Studies conducted for the purpose of establishing the isotopic invariance; 2) measurement of the meson-nucleon interaction constant f; 3) experimental proof of the dispersion relations for meson-nucleon scattering; 4) several studies on nucleon and meson interactions (e.g., on the non-central character of nuclear forces, the role of spin-orbit interaction, nucleon polarization on scattering, etc.). Several (known) details of np scattering and the resonance pion production $p + p \rightarrow \pi^+ + d$ are brought up. 5) Studies of the interaction of unstable particles, pion-pion interaction; 6) first measurements of the muon spin; 7) establishing the β-decay of the π^- meson and proof of the universality of the laws of weak interaction; 8) proof of the excitation of the nucleus by muons as predicted by D. Zaretskiy (non-radiative transitions in uranium); Fig. 5 shows the intensity distribution of

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such a transition 2p - 1S in mesic atoms of lead, bismuth, and uranium; 9) work such as construction of a device used to measure particle tracks automatically; construction of a liquid-hydrogen - deuterium bubble chamber (8 liters) and also research and development connected with new accelerators. Employing an accelerator with a spatial variation of the magnetic field made it possible to prove experimentally that particles may be accelerated up to relativistic energies in such a cyclotron. The most important results achieved by the High-energy Laboratory: All experimental studies of this laboratory have been made by utilizing the 10-Bev proton synchrotron, in which the proton intensity reaches $1 \cdot 10^{10}$ particles per cycle. The new linear accelerator built in 1960 is completed for operation. At present, the following beams are used: 1) a π^- beam having a momentum up to 9 Bev/c in connection with a propane (55 cm), a xenon (55 cm), and a liquid-hydrogen chamber (25 cm); 2) with a negative-particle beam (momentum up to 6 Bev/c) with a liquid-hydrogen chamber (40 cm), a cloud chamber (50 cm), and also with Cherenkov and scintillation counters; 3) a positive-particle beam (5 Bev/c) for work with K^+ mesons by using Cherenkov and scintillation counters and an analogous beam of 2 Bev/c; 4) a K_2^0 beam in connection with a large diffusion chamber; 5) a high-energy neutron beam for work with a 2-m diffu-

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sion chamber; 6) a high-energy neutron beam with Cherenkov counters (total absorption); Fig. 10 shows a diagram of existing beams and of those which will be available in the new experimental pavilion. The most important achievements of this laboratory: 1) investigation of elastic and inelastic NN- and πN high-energy interactions (6-10 Bev); 2) investigation of the strange-particle production (discovery of the anti-sigma-minus-hyperon $\bar{\Sigma}^-$), measuring cross sections and angular distributions when producing Λ_o and Σ particles, K mesons and Ξ hyperons. Investigation of the Kπ interaction, discovery of the longitudinal polarization of Λ_o hyperons in their plane of production (violation of spatial parity in strong interaction); proof of the nucleon structure: core + pion shell. Achievements of the Neutron-physics Laboratory: The Laboratory has taken over the further development and construction of the pulsed fast-neutron reactor ИБР (IBR) which has been designed by the Fizicheskiy institut Gosudarstvennogo komiteta po ispol'zovaniyu atomnoy energii (Institute of Physics of the State Committee for Application of Atomic Energy) (details on this reactor will be later published in this periodical). Fig. 21 shows the form of a neutron pulse of this reactor. The Laboratory mainly is engaged with: 1) the analysis of this reactor; 2) the analysis of the energy dependence

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of neutron reaction cross sections, especially resonance neutrons, and investigations on a neutron scintillation detector made of methyl borate (diameter: 25 mm) and a 1000-channel time analyzer. Achievements of the Nuclear Reaction Laboratory: The building of this laboratory has been constructed recently, and also an accelerator for multiply-charged ions has been installed. Therefore, investigations have been done in Moscow, in the Ordena Lenina Institut atomnoy energii im. I. V. Kurchatova ("Order of Lenin" Institute of Atomic Energy im. I. V. Kurchatov). The interaction of heavy ions with nuclei has been investigated, and work has been done on the synthesis of the element 102; the isotope 102^{253} has been obtained in 1957. Achievements of the Laboratoriya teoreticheskoy fiziki: The building was constructed in 1957; a collective of 88 theorists is working in it; there is also the computation center and the library. The main efforts have been done in the field of dispersion relations, the theory of superconductivity (N. N. Bogolyubov) and its application to the atomic nucleus, and the theory of particles (M. A. Markov). B. M. Pontekorvo has obtained very interesting results in neutrino theory. In addition, extensive work has been done in the field of the phenomenological theory of particle scattering and the theory of interpretation of experiments. The computation center

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does its calculations with the computers "Ural-1" and "Kiyev" and is also engaged in programing methods. In 1960 a new building was erected and a modern computer installed, which was put into service in 1961. The center is also dealing with problems of automatic evaluation of chamber pictures and emulsion layers. Three automatic machines for evaluating films have been built. At present, 420 scientists are working at the OIYaI; in 1961 a branch of the fizicheskiy fakul'tet Moskovskogo gosudarstvennogo universiteta imeni M. V. Lomonosova (Department of Physics, Moscow State University imeni M. V. Lomonosov) has been opened. The international connections of the Institute cover all Soviet-bloc countries, and there is a close cooperation with scientific institutes of these countries; the OIYaI has taken part in numerous conferences including those which have taken place in western countries (Rochester, CERN, Berkeley). Finally, the second five-year program of institutes is dealt with; the main aim is and will be fundamental research in the field of physics of elementary particles and of the nucleus (investigation of the particle structure, the particle production laws, and the particle interaction laws). Professor V. Petr'zilka is mentioned. There are 28 figures and 1 table.

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AUTHORS: Blokhin, G. Ye., Blokhintsev, D. I., Blyumkina, Yu. A., Bondarenko, I. I. Deryagin, B. N., Zaymovskiy, A. S., Zinov'yev, V. P., Kazachkovskiy, O. D., Kim Khen Bon, Krasnoyarov, N. V., Leypunskiy, A. I., Malykh, V. A. Nazarov, P. M., Nikolayev, S. K., Stavisskiy, V. Ya., Ukraintsev, F. I., Frank, I. M., Shapiro, F. L., Yazvitskiy, Yu. S.

TITLE: A pulsed fast reactor

X

PERIODICAL: Atomnaya energiya, v. 10, no. 5, 1961, 437-446

TEXT: The present paper gives a description of the pulsed fast reactor of the Ob"yedinennyy institut yadernykh issledovaniy (Joint Institute of Nuclear Research) which became critical in June, 1960. This reactor, called ИБР (IBR) reactor, serves as pulsed fast neutron source (mean power ≈1 kw) for physical investigations, particularly for time-of-flight experiments. Its most distinguishing feature is the very small contribution ($\sim 10^{-4}$) of the delayed neutrons in its normal operation; it is about

A pulsed fast reactor

one hundredth of that of the usual steady uranium reactor. The pulses appear because whenever the reactor becomes overcritical a burst of prompt neutrons results. The half width of these pulses is 36 μsec. The frequency with which the pulses are repeated can be varied between 8 and 80 pulses/sec. Fig. 2 shows the construction of this reactor. The periodic change in the reactivity is brought about by the displacement of the two U^{235} blocks placed in two disks that can be rotated. The main block is pressed in the form of a disk, 1100 mm in diameter, and can be rotated with a peripheral velocity of 276 m/sec (at 6000 rpm) during which it passes through the core center. The reactivity change obtainable from the motion of the main block is 7.4 %, that obtainable from the motion of the auxiliary block is 0.4 %. The stationary part of the core consists of plutonium lumps in steel jackets. The reactor is started by a rough regulator, in this case a movable part of the reflector. It gives a reactivity change at the rate of $13 \cdot 10^{-5} - 1.3 \cdot 10^{-5}$ sec^{-1}. The manually operated rod is also a part of the reflector. Two plutonium rods in electromagnetic suspension serve as scram. They can be separated from the core with an acceleration of 20 g. Their separation causes a reactivity

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